Bowel Perforation Secondary to Ventriculoperitoneal Shunt: Case Report and Clinical Analysis

F ZHOU, G CHEN AND J ZHANG

Department of Neurosurgery, Second Affiliated Hospital, School of Medicine, Zhejiang University, Hangzhou, People’s Republic of China

Bowel perforation is an unusual complication of ventriculoperitoneal shunting. This article describes a case of bowel perforation associated with a ventriculoperitoneal shunt inserted in an 8-month-old male infant for meningocoele and hydrocephalus. Ten months after insertion of the shunt the infant presented with the shunting tube protruding through the anus. There were no signs of meningitis or peritonitis. At laparotomy the tube was seen to enter the transverse colon and was encapsulated by the greater omentum. The tube was cut and the distal end removed via the anus. The transverse colon was repaired. The catheter continued to function effectively and the patient remained asymptomatic. The literature on this rare complication is reviewed and the therapeutic options are discussed.

KEY WORDS: HYDROCEPHALUS; VENTRICULOPERITONEAL SHUNT; BOWEL PERFORATION

Introduction
The ventriculoperitoneal (VP) shunt has become a popular operation to achieve cerebrospinal fluid (CSF) diversion. It is a relatively simple procedure that can be performed safely early in infancy and is associated with low revision and low complication rates.\(^1\) Several rare late abdominal complications can occur, however, including intestinal volvulus, pseudocyst and extrusion through the scrotum, umbilicus, vagina or gastrointestinal tract.\(^2,3\) Bowel perforation is a relatively unusual complication of VP shunt, occurring in only 0.1 – 1.0% of patients.\(^4 – 7\) Familiarity with this possible complication and its early diagnosis are important for its prognosis.\(^3\) We report here a case of bowel perforation after VP shunt, and review the literature and therapeutic options.

Case report
A male infant aged 8 months with meningocoele of the occiput and hydrocephalus underwent repair of the meningocoele and a VP shunt with a Silastic\(^{®}\) catheter inserted without incident apart from transient diarrhoea. Ten months later his mother observed the expulsion of a long white tube through the anus during a bowel movement and brought him to our department. The infant had no history of peritoneal infection.
EXAMINATION
The shunting tube was seen protruding from the anus. The infant was alert, active and neurologically normal, with no signs of meningitis or peritonitis. His temperature was 36.9 °C and the peripheral white blood cell count was normal.

SURGERY
A suture was placed through the distal catheter tubing to prevent its retraction. A laparotomy incision was performed at the right epigastrium over the shunting tubing. The tube was seen to be entering the transverse colon and was encapsulated by the greater omentum. There were adhesions between the peritoneal tube and colon near the perforating site. The tube was cut at the point where it entered the transverse colon and the protruding distal end was pulled out from the anus. The transverse colon was repaired immediately.

Clear CSF drained from the tube; examination of the CSF revealed a normal cell count, with a glucose level of 58 mg/dl and a protein level of 40 mg/dl. Broad-spectrum antibiotics were given and the infant recovered quickly. Culture of the CSF was negative. The catheter continued to function effectively and a computed tomography scan 1 year later revealed normal-sized ventricles. After 2 years' follow-up, the patient remains asymptomatic.

Discussion
Bowel perforation as a complication of VP shunt was first reported by Wilson and Bertan in two hydrocephalic infants. Since then, about 87 perforations have been documented worldwide, giving an incidence of 0.1 – 1.0%; the Raimondi spring-coiled peritoneal catheter has been implicated in more than 50% of these documented cases. The introduction of softer, more flexible Silastic tubing has led to a reduction in incidence but not elimination of this complication.

The exact pathogenesis of bowel perforation after VP shunt is difficult to discern. Many authors have described the formation of encasing fibrosis around the tube both at surgery and at autopsy. This fibrosis is thought to have an anchoring effect on the tube, resulting in pressure and decubitus ulceration on an area of the bowel that eventually leads to perforation. In the case reported here, adhesions were seen between the peritoneal tube and the colon near the perforating site. Since the infant had no history of peritoneal infection, the first operative procedure may have lead to these adhesions.

Children with myelomeningocele and congenital hydrocephalus may be more susceptible to developing perforation due to a weakness in the bowel wall resulting from deficient innervation. Whether the length of the abdominal end of the tubing has a role in the formation of bowel perforation is unclear. Evidence of silicone allergy, which may result in a foreign body-like reaction, has been implicated in the breakdown and perforation of the bowel.

The absence of peritoneal signs is usual in cases of bowel perforation by a VP shunt. Less than 15 – 25% of reported cases with demonstrated bowel perforation had an associated clinical peritonitis, but 43 – 48% of cases developed meningitis or ventriculitis. Escherichia coli is the most common organism in CSF cultures. In the case reported here, obvious peritoneal signs were absent, the only sign being the tube protruding from the anus. Any patient with a VP shunt who presents with ventriculitis or meningitis due to an enteric organism should be assessed for bowel perforation. Similarly, prolonged diarrhoea of unknown
Bowel perforation secondary to ventriculoperitoneal shunt

F Zhou, G Chen, J Zhang

aetiology, as well as abdominal symptoms, should serve as warning signs of possible bowel perforation.

While the diagnosis of bowel perforation is apparent on appearance of the protruding tube, abdominal radiology (X-ray or computed tomography), could be used to make the diagnosis when it is less obvious.\(^5\) In cases where there is a high index of suspicion, a valvogram with instillation of the contrast medium, metrizamide, into the lower end of the shunt tube has been used to demonstrate perforation.\(^5,17\) Alternatively, colonoscopy could be performed.

Management of bowel perforation must be tailored to the individual circumstances. The initial step is to check for CSF infection due to retrograde spread, leading to ventriculitis or meningitis. If there is no accompanying peritonitis or abdominal abscess, the tube can be directly removed by laparotomy or even percutaneously.\(^5\)

Colonoscopic or proctoscopic apparatus have also been successfully used to remove the distal part of the VP catheter. If there is significant abdominal infectious pathology, such as abscess or life-threatening peritonitis, the fistulous opening may not close spontaneously and laparotomy should be performed.

When bowel perforation is detected at an asymptomatic stage, the prognosis for recovery is excellent; the highest mortality rate is associated with patients who present with predominantly abdominal complications. Familiarity with the possibility of bowel perforation associated with VP shunts, together with early diagnosis, are necessary to minimize the consequences of this rare complication.

Conflicts of interest

No conflicts of interest were declared in relation to this paper.

References

12. Chen HS: Rectal penetration by a disconnected ventriculoperitoneal shunt tube: an unusual

Author's address for correspondence
Dr Gao Chen
Department of Neurosurgery, Second Affiliated Hospital, School of Medicine, Zhejiang University, 88 Jiefang Road, Hangzhou, People’s Republic of China.
E-mail: d.chengao@163.com