Mixed bacterial meningitis: A complication of ventriculo- and lumboperitoneal shunts

Report of two cases

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Infectious complications of ventriculo- and lumboperitoneal shunts in two patients are presented. Cerebrospinal fluid infection due to aerobic and anaerobic enteric flora was characteristic of each case. Both infections occurred several months after shunt surgery and were associated with colonic perforation by the distal limb of the peritoneal catheter. These cases emphasize this unusual hazard of peritoneal shunts and demonstrate methods for diagnosis and effective therapy.

KEY WORDS • infection • ventriculoperitoneal shunt • lumboperitoneal shunt

Ventriculoperitoneal (V-P) shunts for the treatment of hydrocephalus have been in use since their introduction in 1905. Although the occurrence of infectious complications following placement of V-P shunts has been lower than with ventriculauricular shunts, the incidence of obstruction at the proximal or distal ends of the catheter and retraction from the original placement site have been higher with V-P shunts.

This report concerns two patients with unusual complications of V-P or lumboperitoneal (L-P) shunts. Meningitis due to multiple organisms occurred in both patients following perforation of the colon by the distal portion of the shunt.

Case Reports

Case 1

This 20-year-old woman was admitted with a history of headache and vomiting for 4 days. Past history included involvement in an auto accident at 14 days of age; correction of a patent ductus arteriosus at the age of 10 years; and placement of an L-P shunt* 6 months before admission for communicating hydrocephalus. One month after surgery, an episode of meningitis due to S. epidermidis

*Shunt manufactured by Holter Corporation, Division of Extracorporeal Medical Specialties, Inc., Royal and Ross Roads, King of Prussia, Pennsylvania.
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occurred which subsequently responded to methicillin therapy.

**Examination.** Physical examination on admission revealed a poorly developed woman in acute distress. Her weight was 45 kg; blood pressure, 100/70 mm Hg; temperature 101.8° F; and heart rate, 100/min. A Brudzinski sign was present. A Grade 4/6 holosystolic murmur was heard at the apex. Examination of the abdomen revealed no tenderness or masses.

Laboratory studies on admission including serum electrolytes, liver enzymes, total protein, bilirubin, and creatinine were within normal limits. Lumbar puncture revealed an opening pressure of 188 mm H₂O; cerebrospinal fluid (CSF) protein, 860 mg/dl; and glucose, 10 mg/dl (blood glucose, 106 mg/dl%), with 40,000 red blood cells (RBC's) and 161,700 white blood cells (WBC's) of which 76% were polymorphonuclear leukocytes. Gram stain of the CSF revealed Gram-positive cocci and weakly staining Gram-negative rods.

Antibiotic therapy was instituted with intravenously administered methicillin (200 mg/kg/day) and intramuscular gentamicin (5.0 mg/kg/day). Aerobic cultures of the CSF yielded *E. coli* and alpha streptococci, therefore penicillin-G (20 million units/day) was substituted for methicillin on the second hospital day. Anaerobic cultures yielded peptostreptococci and *Bacteroides fragilis*, and chloramphenicol (3.0 gm/day) was added to her antibiotic regimen on the fourth hospital day. However, the patient's clinical condition did not improve and CSF findings remained unchanged. In addition, her course was complicated by hyponatremia and hypokalemia. Because of the presence of a mixed-organism meningitis, perforation of the gastrointestinal tract by the peritoneal catheter was suspected. Following injection of carmine red dye into the CSF at the lumbar level, dye appeared in the patient's stool within 6 hours.

**Operation.** Surgical exploration was performed on the fifth hospital day and demonstrated penetration of the distal peritoneal catheter into the transverse colon. X-ray films taken at surgery following injection of radiopaque dye into the proximal end of the shunt catheter documented the perforation and a subarachnoid-colonic communication (Fig. 1). The shunt appliance was removed and the colonic perforation was closed.

**Postoperative Course.** Marked improvement in the patient's clinical condition was noted in the immediate postoperative period, with concomitant improvement in CSF indices. However, 3 days after surgery the patient again became febrile with temperatures to 102.8° F. An increase in CSF pleocytosis was observed and the CSF cultures again became positive for *E. coli*. Thereafter, her clinical condition slowly improved, with subsequent return to normal of the CSF count, protein, and glucose. Antibiotic therapy was continued for 3 weeks. Following removal of the shunt, there was no evidence of increased intracranial pressure and the shunt was not replaced.

**Case 2**

This 48-year-old woman was transferred from a chronic care hospital with a diagnosis of Gram-negative meningitis for which she had received cephalothin (8 gm/day, intravenously, for 6 days). Past history included the placement of a V-P shunt† 9 months before admission for progressive hydrocephalus. Four weeks after surgery she had been successfully treated with methicillin for *S. epidermidis* meningitis.

†Shunt manufactured by Heyer-Schulte Corporation, 600 Tine Avenue, Goleta, California.
Meningitis in ventriculo- and lumboperitoneal shunts

**Examination.** Physical examination on admission revealed a lethargic, aphasic woman with right spastic hemiparesis. Blood pressure was 150/90 mm Hg; pulse, 65/min; respirations, 20/min; and temperature, 102° F.

Lumbar puncture revealed an opening pressure of less than 50 cm H2O; CSF protein was 238 mg/dl, CSF glucose was 10 mg/dl (serum glucose, 83 mg/dl), there were 590 WBC’s/cu mm, 60% of which were polymorphonuclear neutrophils. Gram stain was negative but subsequent aerobic culture grew *E. coli*. X-ray films of the skull, chest, and abdomen revealed that the V-P shunt passed down the right posterior aspect of the skull and terminated in the right upper abdomen. There were no pathological findings on abdominal x-ray films, and no evidence of free air or fluid was noted in the peritoneal cavity. The patient was treated with kanamycin (15 mg/kg/day, intramuscularly) and cephalothin. However, CSF cultures remained positive for *E. coli*.

**Operation.** On the seventh hospital day, exploratory laparotomy revealed that the shunt had perforated the colon. The distal part of the shunt contained fecal material which on culture yielded *E. coli*, *Proteus mirabilis*, and *Streptococcus fecalis*.

**Postoperative Course.** Following removal of the shunt, antibiotic therapy was changed to gentamicin (5.0 mg/kg/day, intravenously) with cephalothin. Her condition failed to improve; *E. coli* and *Bacteroides fragilis* were isolated from the CSF on repeated occasions. In addition, an abscess with an associated sinus tract developed at the former site of the shunt in the right side of the neck. The abscess was drained and the tract excised; cultures yielded *E. coli*. Following these surgical procedures and the addition of chloramphenicol (3.0 gm/day, intravenously), the patient’s clinical condition gradually improved. Subsequently her shunt was not replaced since no signs of increased pressure followed removal.

**Discussion**

These two cases illustrate an unusual complication of V-P and L-P shunts. After placement in the peritoneal cavity, the distal end of the catheter penetrated the colon with retrograde contamination of the CSF with enteric flora. In both cases, meningitis was caused by multiple microorganisms. The isolation of *E. coli* and *Bacteroides fragilis* (the most common enteric aerobic and anaerobic flora, respectively) were common to both cases. Similarly, in both patients, an interval of approximately 6 months elapsed following the placement of the shunt and the subsequent occurrence of meningitis.

Both patients had had an immediate infectious complication with *S. epidermidis* following the placement of the shunt. This organism has been shown to be the most frequent cause of meningitis following implantation of V-P shunts. In a recent study, *S. epidermidis* was isolated in 12 of 19 infections following V-P shunt surgery; *S. aureus*, enterococci, alpha streptococci, and a Gram-negative enteric bacteria accounted for the remainder. Postsurgical meningitis in this series had a peak incidence (15 of 19) in the first month. Therefore, the isolation of *E. coli* and *Bacteroides fragilis* following shunt surgery is unusual and should alert the physician to the possibility of the penetration of the gastrointestinal tract by a peritoneal shunt.

It is of interest that even after removal of the shunt, positive cultures recurred in both of our patients 3 to 4 days later. Therefore, although the removal of the shunt aided the eradication of the infection it was not totally adequate. This is in contrast to the experience with infections without associated perforation. In the second patient, failure to initially attain bacteriological cure was due to the lack of antibiotic coverage against anaerobic organisms, and *B. fragilis* emerged as a causative organism after the suppression of *E. coli* with gentamicin therapy. In the first patient, the recurrence of infection with *E. coli* could have been due to continued seeding of the organisms from the sinus tract, which developed after removal of the shunt, or due to rupture of a small abscess in the subarachnoid space. An attempt was made before surgery to diagnose whether the shunt was penetrating the colon in the first patient by the introduction of carmine dye into the CSF with subsequent observation of stools. Also, contrast material was effective in demonstrating the location of the distal end of the shunt in the colon by injection of the catheter with radiopaque dye at the time of surgery. In summary, the late occurrence of signs and symptoms of meningitis following shunt placement, which subsequently proves
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to be a mixed anaerobic infection, should raise suspicion of a possible enteric perforation. Surgical repair of the perforation as well as removal of the shunt may be necessary to eradicate infection.

References

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