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Minilaparoscopically assisted placement of ventriculoperitoneal shunts

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Abstract

Background: Ventriculoperitoneal (VP) shunting remains the preferred treatment for hydrocephalus. Laparoscopic techniques to aid in the placement of the peritoneal portion of the catheter have been reported previously. We describe a minilaparoscopic VP shunt (MLVPS) insertion technique that facilitates directed placement of the peritoneal portion of the catheter in most patients, including those with obese abdomens previously subjected to surgery. In this study we review our experience with MLVPS placement.

Methods: All cases of MLVPS insertions at the University of Kentucky Medical Center and Lexington VA Hospital performed between February 1998 and March 1999 were reviewed retrospectively. A total of 27 patients (13 males and 14 females) ranging in age from 4 to 81 years (mean, 41 years) underwent VP shunting. The MLVPS insertion was performed via a 2-mm laparoscope and a separate 2-mm incision for catheter insertion using a venous introducer kit. In patients who had prior abdominal surgery, a 5-mm direct-view trocar was used.

Results: The MLVPS procedure was successful in 27 patients (100%). The mean number of prior shunts was 2 (range, 0–28). Of the 27 patients, 16 (59%) had undergone previous abdominal surgery. The mean operative time was 76 min (range, 19–155 min). There were no intra- or postoperative complications, and no mortalities. The follow-up period extended from 1 to 12 months.

Conclusions: Findings show MLVPS placement to be safe and feasible. It allows accurate, directed placement of the VP shunt with a 2-mm laparoscope and a second 2-mm incision for shunt insertion. The procedure is associated with reduced trauma to the abdominal wall and minimal postoperative ileus. Long-term follow-up assessment of shunt function is planned.

Key words: Hydrocephalus — Laparoscopy — Ventriculoperitoneal shunt — Minilaparoscopy

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Ventriculoperitoneal (VP) shunting is the most common treatment for hydrocephalus. Malpositioning of the peritoneal portion of the shunt tubing is a frequent cause for shunt failure. Patient factors such as obesity, altered abdominal contour, and previous surgical scars can make placement of the peritoneal portion of the catheter difficult. As a result, a large abdominal incision may be required to ensure that the catheter is positioned appropriately in a free portion of the peritoneal cavity. Often, the laparotomy incision is the source of the greatest perioperative morbidity and can result in prolonged ileus and hospitalization [3]. The minilaparoscopic technique allows for directed catheter placement with minimal abdominal wall trauma.

Patients and methods

All patients undergoing minilaparoscopic VP shunt (MLVPS) placement between February 1998 and March 1999 at the University of Kentucky Medical Center and Lexington Kentucky VA Hospital were reviewed retrospectively. Data collected on these patients included age, gender, diagnosis, number of prior shunts, prior abdominal operations, operative time, time to resumption of enteric nutrition, complications, and follow-up evaluation.

Operative technique

The patient is positioned in the supine position with the head turned laterally. A roll is placed under the shoulders for extension. The scalp, neck, chest, and abdomen are prepped and draped sterilely. A 1-in. incision is made just anteriorly to the coronal suture and in the midpupillary line. An 11-mm perforator is used to make a burr hole. The dura is coagulated with bipolar cautery and opened in a cruciate fashion. A 0.9-mm rigid fiberoptic ventriculoscope (Integra NeuroCare, Plainsboro, NJ) is advanced through a standard ventricular catheter with a "fishmouth" slit at the tip. With the ventriculoscope used as a stylet, the scope and catheter are advanced into the frontal horn of the lateral ventricle. A trajectory perpendicular to the skull, aiming for the tragus and medial canthus, is used to a depth of 5 cm. The ventriculoscope then is advanced through the slit at the end of the catheter to confirm intraventricular placement. The optimal position for the tip of the catheter is just above the foramen of Monro.

Once positioned, the ventriculoscope is withdrawn leaving the catheter behind. The ventricular catheter is trimmed flush with the burr hole and attached to the distal end of the shunt.

A subgaleal pocket is made to accommodate the shunt valve, and the

Table 1. Indication for minilaparoscopic ventriculoperitoneal shunt

Diagnosis	Number of patients
Congenital hydrocephalus	7
Traumatic closed head injury	4
Metastatic tumor	4
Intracranial tumor	3
Arachnoid cyst	2
Subarachnoid hemorrhage	2
Subdural hemorrhage	2
Intraventricular hemorrhage	2
Pseudotumor cerebri	1

distal peritoneal tubing is then tunneled to a small stab incision behind the ear. The valve is pumped to fill the shunt with cerebrospinal fluid (CSF). A 2-mm stab incision then is made at the umbilicus, and a Veress needle/port is introduced into the peritoneal cavity. After gentle aspiration and injection of air through the needle to confirm location, carbon dioxide pneumoperitoneum is created to a pressure of 10 to 15 mmHg. A 2-mm laparoscope then is inserted through this port to identify a location suitable for placing the peritoneal portion of the catheter. In patients with previous abdominal surgery, a 5-mm direct-view trocar (Optiview trocar, Ethicon Endosurgery Cincinnati, OH, USA) is used to visualize the layers of the abdominal wall as the trocar is inserted and to avoid adhesions and bowel injury.

Once the laparoscope is inserted, the abdomen is surveyed to identify adhesions or loculated cavities. When a favorable location for peritoneal insertion of the shunt has been identified, using both external palpation on the abdominal wall and direct laparoscopic visualization, a 2-mm skin incision is made. A tunneler is used to bring the peritoneal tubing from behind the ear to the stab incision on the abdomen. A needle and guidewire are passed through the incision into the peritoneal cavity under endoscopic control. Over the guidewire, a peel-away introducer sheath (8, 9, or 10 Fr) is passed into the peritoneum, again under direct endoscopic vision. Through this sheath, the distal peritoneal tubing is passed, and then the sheath peeled away. The endoscope then is used to confirm optimal placement of the distal shunt with the peritoneum. Patency of the shunt is confirmed by visualization of CSF draining from the catheter tip (with pumping of the subgaleal valve). The laparoscope is removed and pneumoperitoneum evacuated. Finally, the trocar is removed and the incisions are closed using steristrips.

Results

A total of 27 patients (13 males and 14 females) were scheduled for MLVPS placement between February 1998 and March 1999. All the patients underwent successful placement of the peritoneal portion of the catheter using the minilaparoscopic technique. The mean patient age was 41 years (range, 4–81 years). The indications for VP shunting in this series are listed in Table 1. Ten patients (36%) had previously undergone open VP shunting (Table 2). The mean number of prior shunts was 2 (range, 0–28). Of the 27 patients, 16 (59%) had previously undergone other abdominal procedures (Table 3). Mean operative time was 76 min (range, 19–155 min). The mean length of time to resumption of postoperative enteric feeding (either orally or via feeding tube) was 1.2 h (range, 0–24 h). There were no procedure-related complications or deaths.

Discussion

A laparoscopic approach to the placement of the peritoneal portion of VP shunt catheters was first described in 1993 [1]. The laparoscopic technique allows the shunt catheter to be positioned under direct visualization into a selected region of the peritoneal cavity free from adhesions. Early reports of laparoscopic VP shunt placement describe the use of a 10-mm laparoscope, with up to three additional trocars [2, 5, 7] used for adhesiolysis and intracorporeal manipulation of the catheter.

The MLVPS placement technique similarly allows for directed placement of the shunt catheter into the peritoneal cavity, using two 2-mm incisions. The optical quality of the 2-mm laparoscope allows for clear visualization of the shunt catheter as it is inserted into the abdomen. Once the catheter is positioned, shunt patency is confirmed by the visualization of CSF draining from the catheter tip.

The minilaparoscopic approach offers the advantages of the previously described techniques while further minimizing abdominal wall trauma. The procedure is performed using a 2-mm incision for the laparoscope and a second 2-mm incision for the introducer through which the shunt is advanced. The minilaparoscopic incisions are associated with enhanced postoperative cardiorespiratory performance and reduced postoperative pulmonary restrictions [8].

The MLVPS procedure may be performed safely on patients with prior abdominal surgery. In this patient population, a 5-mm direct-view trocar is used to avoid adhesions as the trocar is introduced. In our study, 16 patients (59%) had prior abdominal surgery, and none of these patients required placement of an additional trocar for adhesiolysis. Strategic trocar placement away from prior surgical scars facilitates positioning of the catheter in an area free of adhesions without performing adhesiolysis.

Although an extensive comparison of the MLVPS experience with that of open VP shunt (OVPS) patients was not the focus of this study, the operative time for MLVPS compared favorably with that for OVPS. In our experience, there have been no postoperative complications after MLVPS. Injuries to the abdominal viscera are avoided by direct visualization of the catheter during insertion. Injuries to the vagina, urinary bladder, gallbladder, and bowel [9] all have been described with the open procedure. These injuries may be avoided using the laparoscopic technique. Postoperative ileus after MLVPS is minimal, and most patients are able to resume oral intake or tube feeds in the recovery room.

Laparoscopic VP shunting is a safe alternative to conventional open techniques. We believe that the minilaparoscopic approach further reduces abdominal wall trauma and postoperative morbidity. Whereas an improved functional recovery in MLVPS compared with that in conventional laparoscopic VP shunt patients is difficult to demonstrate, the cosmetic advantage is immediately apparent. The MLVPS procedure is almost scarless. Within 1 month the abdominal incisions are essentially invisible.

Some authors have proclaimed the superiority of a particular minilaparoscopic procedure over its laparoscopic counterpart [4, 10]. Yuan et al [10] supported their contention that minilaparoscopic cholecystectomy is superior to standard laparoscopic cholecystectomy with evidence of lower analgesic usage, quicker resumption of postoperative oral intake, and shorter postoperative hospital stay. This was not a randomized prospective study, so their conclusions should be considered accordingly.

Using the MLVPS technique, the peritoneal portion of the catheter may be positioned safely in an optimal location

Table 2. Minilaparoscopic ventriculoperitoneal shunt and prior ventriculoperitoneal shunt placement

Number of prior shunts	Number of patients
0	18
1	5
2	2
7	1
10	1
28	1

Table 3. Minilaparoscopic ventriculoperitoneal shunt and prior abdominal surgery

Prior operation	Number of patients
None	11
Prior VP shunt	10
Percutaneous endoscopic gastrostomy	4
Cesarean section	2
Open cholecystectomy	1
Exploratory Laparotomy—small bowel resection	1
Resection of abdominal wall mass	1
Marsupialization of shunt pseudocyst	1
Total abdominal hysterectomy	1

under direct visualization. Although all patient populations may benefit from the MLVPS technique, patients with prior abdominal surgery and altered abdominal contour may enjoy the greatest benefit from this innovative technique that ensures appropriate catheter placement within the peritoneal cavity while avoiding large laparotomy incisions.

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