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Laparoscopic ventriculoperitoneal shunt placement

A single-trocar technique

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Abstract. Ventriculoperitoneal shunt (VPS) placement is an important therapeutic technique. Placement of the abdominal portion of VPS can be difficult in the setting of previous abdominal surgery, prior failure of VPS, or obesity. Even under ideal circumstances, standard mini-laparotomy does not allow precision in VPS positioning. We describe a single-port technique for VPS placement. While the neurosurgeon places a right frontal ventricular catheter and valve, an infraumbilical trocar is placed utilizing the open Hasson technique. A 12-mm operating laparoscope with an 8-mm channel is used to inspect the abdomen and identify the VPS entry site. Adhesions interfering with shunt placement can be lysed through the working channel of the laparoscope. Under laparoscopic visualization, an 18-gauge needle is introduced through a 5-mm incision in the right upper quadrant and the VPS tubing is tunneled to that site. A J-tipped guidewire is introduced, and the needle is exchanged for a dilator and peel-away sheath. The VPS is delivered through the sheath, which is sectioned and removed. An atraumatic grasper, placed through the laparoscope, directs the VPS to the desired intraabdominal location. Function of the VPS is assessed visually while compressing the valve. Suture closure of the trocar site and VPS entry site completes the procedure. We used this method successfully in a series of five patients with excellent outcome. A 14-month follow-up has revealed no failures or postoperative complications. This method is less invasive than mini-laparotomy, allows for precision placement of the abdominal portion of VPS, and confirms appropriate function.

Key words: Hydrocephalus — Laparoscopy — Ventriculoperitoneal shunt

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The placement of ventriculoperitoneal shunts (VPS) plays an important role in the treatment of hydrocephalus. The shunt is tunneled subcutaneously from the head to the abdomen, where a right upper quadrant incision allows placement of the catheter tip in the peritoneal cavity. The abdominal placement of the catheter has traditionally been performed blindly, with shunt function assessed solely via compression of the VPS pump valve mechanism and postoperative neurologic changes.

Blind placement of the catheter tip does not allow assessment of the quality of cerebrospinal fluid (CSF) flow. Shunt failure, which typically occurs at the peritoneal end, has been reported to occur in 25–30% of cases [2]. Imprecise catheter tip placement may contribute to shunt failure or intraabdominal complications4]. Traditional blind catheter placement in obese patients and those with adhesions from prior abdominal surgery can be difficult.

Laparoscopic-assisted placement of the abdominal portion of VPS utilizing up to four ports has been described [1]. Laparoscopic placement allows for intraabdominal inspection, confirmation of precise catheter positioning, and assessment of the quality of CSF flow at the catheter tip. We describe a single-port technique that reduces operative time, may be associated with fewer complications, and is potentially less stressful than multiple-port placement.

Materials and methods

The VPS catheter is tunneled subcutaneously from the head to the abdomen (Fig. 1). The intracranial portion of the procedure is completed by the neurosurgeon while the general surgeon accesses the abdomen. A 15-mm curvilinear incision is created in the infraumbilical region, and the peritoneal cavity is entered using the open Hasson technique.

Once the 12-mm blunt-tipped trocar has been inserted, the abdomen is insufflated to a pressure of 14 mmHg with carbon dioxide. A 12-mm Wolf Lumina SL (Vernon Hills, IL, USA) operating telescope with an 8-mm working channel is inserted through the previously placed port and the peritoneal cavity inspected.

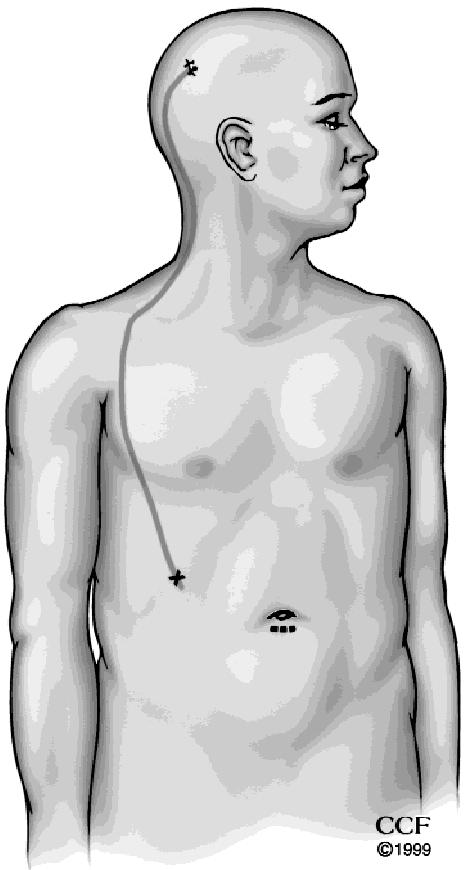

Fig. 1. Typical subcutaneous position of ventriculoperitoneal shunt (VPS). Initial Hasson entry site in the infraumbilical position and entry site of the peritoneal portion of the catheter in the right upper quadrant are shown.

The right upper quadrant is palpated, and a suitable site for catheter insertion is chosen. This area should be free of adhesions to allow optimal placement of the VPS catheter. Adhesioloysis can be performed through the operating telescope utilizing cautery shears or the harmonic scalpel. In cases where visualization is likely to be compromised by adhesions from extensive prior abdominal surgery, we recommend the use of alternate sites for placement of the Hasson trocar [3]. A 3-mm incision is created at the site selected for VPS entry into the peritoneum, and an 18-gauge needle is inserted through this incision under laparoscopic visualization. The needle is exchanged over a 0.025-in J-tip guidewire for a 12-Fr introducer and peel-away sheath, utilizing the Seldinger technique. The introducer is removed, leaving the peel-away sheath traversing the abdominal wall, and the distal tip of the VPS catheter is introduced through the sheath into the peritoneal cavity. An atraumatic grasper introduced through the 8-mm working channel of the laparoscope is used to grasp the VPS catheter and guide its tip into the pelvis (Fig. 2). To assess the adequacy of CSF flow, the catheter tip is inspected while the pump valve mechanism of the VPS is activated. Once excellent CSF flow and catheter position are confirmed, the sheath is peeled and removed. The operating telescope and Hasson port are removed, and the abdominal cavity is decompressed. Fascial closure is accomplished at the umbilicus, and the skin is closed at both sites according to surgeon preference.

Results

We have performed laparoscopic-assisted VPS placement in five patients utilizing this single-port technique. Each patient demonstrated neurologic improvement after VPS placement, and none has required reexploration for shunt failure during 14-month follow-up. There have been no intraoperative complications or postoperative infections to date. Enteral feeding was resumed the day of surgery in each patient.

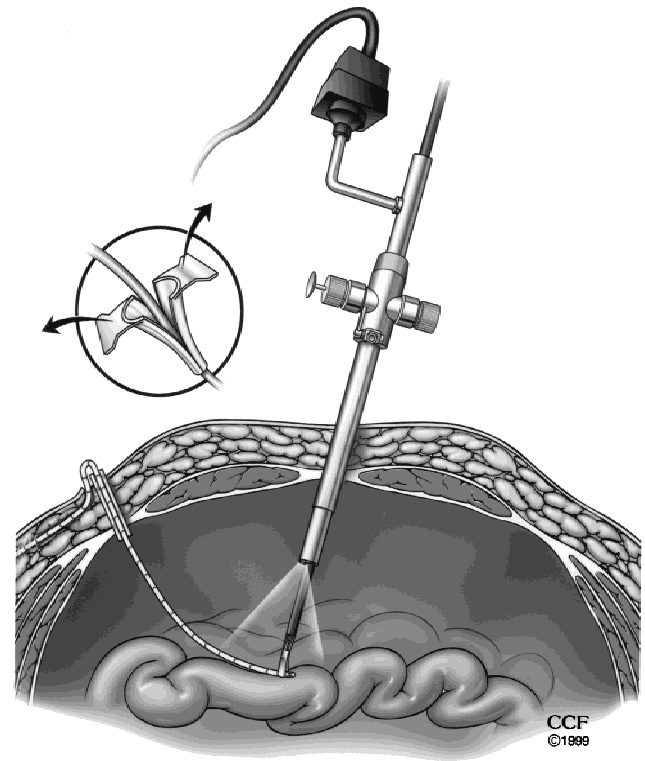

Fig. 2. An atraumatic grasper is used to direct the tip of the catheter into the appropriate pelvic position. The catheter enters the peritoneal cavity through a peel-away sheath in the right upper quadrant.

Discussion

Direct visualization during laparoscopic VPS placement enables the surgeon to assure proper position and intraoperative function. Obesity, adhesions, catheter kinking, and the inability to confirm VPS function visually at the time of placement have hampered the success of VPS placed traditionally via blind insertion of the intraabdominal portion. Our technique successfully utilizes a single trocar to accomplish precise positioning of VPS, ensuring function while preserving the benefits of minimally invasive surgery.

We recommend the Hasson technique for initial entry into the abdominal cavity and typically place the trocar in the infraumbilical position. When visualization is likely to be compromised by adhesions from prior abdominal surgery, we utilize alternate sites for placement of the Hasson trocar. We believe that this approach reduces the risk of iatrogenic bowel injury during trocar insertion because it permits peritoneal entry under direct visualization. We have had no bowel injuries to date.

The use of multiple trocars for the laparoscopic-assisted placement of VPS has not been necessary in this series, and we believe that this method has wide application. Further study is warranted to demonstrate the extent of patient ben-

efits, but the visual confirmation of function and excellent postoperative results alone justify consideration of this procedure in all patients undergoing VPS placement.

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