Technical Note

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Surgical technique for preventing subcutaneous migration of distal lumboperitoneal shunt catheters

Abstract: The migration of lumboperitoneal shunt catheters into the abdominal subcutaneous space is not uncommon. To prevent migration we devised a new method for installing the peritoneal tube. After catheter insertion into the lumbar spinal subarachnoid space, the tube on the peritoneal side is pulled into the areolar space between the abdominal fat and the anterior rectus sheath. A 4 cm incision is made in the sheath and the tip of the catheter is obliquely passed through the rectus abdominis muscle using a mosquito clamp. The tube is then inserted into the abdominal cavity through small openings in the posterior sheath and peritoneal membrane, located 3 cm inferior and 3 cm medial to the opening on the anterior rectus sheath. Consequently, the peritoneal tube runs obliquely, upper lateral to lower medial, through the anterior sheath, the rectus abdominis muscle, the posterior sheath, and the peritoneum. To date, we operated on 59 patients using this method. No migration of the abdominal shunt catheter occurred during a follow-up period of 5.51±3.6 months (mean±standard deviation). Our technique is safe, effective without migration of the peritoneal tube, and can be performed in less well-equipped operating rooms.

Keywords: Complication; hydrocephalus; LP shunt; lumboperitoneal shunt; migration.

Introduction

Lumboperitoneal (LP) shunt placement is one of the most common surgeries for the treatment of idiopathic normal pressure hydrocephalus (iNPH), or communicating hydrocephalus, after subarachnoid hemorrhage [12]. It is relatively safe because the shunt catheter does not pass through the central nervous system, however, complications such as subdural hematoma, spinal catheter migration, radiculopathy, abdominal catheter migration, obstruction of the abdominal catheter, and shunt infection can occur [2, 3, 7, 10, 11]. Of these, abdominal shunt catheter migration into the abdominal wall is the most common complication [7, 9, 11]; in our past series its incidence was 9.8%, which was similar to another report [11]. We now use our new method for installing abdominal catheters to prevent migration.

Patients and methods

The patient is placed in a lateral position under intravenous sedation and local anesthesia and a Codman® (Codman & Shurtleff, Inc., Raynham, MA, USA) adjustable Hakim valve (CHPV) or Strata NSC LP shunt kit (Medtronic®, Minneapolis, MN, USA) system is used. The lumbar subarachnoid space is accessed with a Tuohy needle and a spinal catheter is introduced through the needle. Rather than into subcutaneous adipose tissue, the abdominal catheter is guided with a passer into the space between subcutaneous fat tissue and the anterior rectus sheath in the flank (Figure 1). An opening very near the upper lateral corner of the wound is made in the anterior sheath (Figure 2; arrowhead). A 4 cm transverse incision is then placed in the anterior sheath and the muscle is dissected until the posterior sheath appears. Using mosquito forceps, the catheter is passed obliquely through
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the anterior sheath and rectus abdominis muscle, upper lateral to lower medial, and then guided into the space over the posterior sheath (Figure 2). The posterior sheath and peritoneum are incised 3 cm inferior and 3 cm medial to the incision on the anterior sheath and the catheter is inserted into the peritoneal cavity to a length of 30 cm. After insertion, the peritoneal membrane is tightly closed using purse-string sutures and then the posterior sheath is closed with intermittent sutures (Figure 3). The catheter is affixed to the anterior and posterior sheath with absorbable sutures. After closure of the anterior sheath, the subcutaneous fat layer is closed tightly with multiple sutures and the skin is closed.

Results

Between July 2012 and July 2013, we performed LP shunt surgery using our modification in 59 patients, 32 males and 27 females. Of these, 51 presented with iNPH, three with communicating hydrocephalus after subarachnoid hemorrhage, two each with communicating hydrocephalus due to meningeal carcinomatosis or the need for replacement of a malfunctioning shunt system, and one patient manifested communicating hydrocephalus after head trauma. We encountered no migration or obstruction.

Figure 1  The abdominal catheter is pulled into the space between the subcutaneous fat tissue and the anterior rectus sheath at the upper corner of the wound (arrow).

Figure 2  The abdominal catheter is passed obliquely through the anterior sheath and rectus muscle and then introduced into the space over the posterior sheath of the rectus muscle. *Intended opening in the posterior sheath. The opening (arrowhead) in the anterior sheath should be very close to the wound edge (arrow) to avoid catheter redundancy on the anterior sheath.

Figure 3  Photograph obtained after the insertion of the abdominal catheter. Note the oblique position of the catheter, from the upper-lateral to the lower medial direction, on the anterior sheath, rectus muscle (arrowheads), and posterior sheath.
of the abdominal catheter in any of the 59 patients in the course of a 5.51±3.6 months follow-up (mean±standard deviation). Although our rate of abdominal shunt catheter migration was 9.8% in 102 patients who underwent LP shunt surgery before the introduction of this modified technique (Table 1), there is no complication of peritoneal catheter with the present method (Table 2). Post-operative X-ray study revealed that the tip of the abdominal catheter was in the pouch of Douglas in 50 of the 59 patients (84.7%).

**Discussion**

Migration of the abdominal catheter is a common complication of LP shunt surgery, especially in obese patients [3, 6, 9, 11], and surgical modifications to prevent migration have been developed [1, 8, 9]. Proposed mechanisms underlying catheter migration are: (i) an increase in the intra-peritoneal pressure, especially in the upright position that pushes the tube out of the peritoneal space; (ii) the creation by surgery of a wide subcutaneous free space surrounding the catheter that allows catheter redundancy and coiling; (iii) loose subcutaneous adipose tissue, especially in obese patients; (iv) the retraction of the catheter by subcutaneous fat tissue during abdominal motion.

Our modification is based on four basic concepts, that is, minimization of the subcutaneous fat tissue through which the catheter passes, oblique positioning of the part of the catheter in the abdominal muscle to lessen the direct push-out force exerted on the catheter, and anchoring the catheter to the anterior and posterior rectus sheaths. Lastly, as we aim at minimizing the dead space surrounding the catheter, we do not position the catheter in the surgical opening that may become dead space, resulting in insufficient adherence and healing, rather, we place an opening on the anterior sheath near the upper lateral edge of the wound.

The oblique positioning of the catheter also facilitates stabilization of the catheter tip in the pouch of Douglas; this has been reported as the most appropriate tip position [4, 5].

Laparoscopy has been used for the installation of abdominal catheters [1, 8]. Similar to our modification, it minimizes the space surrounding the catheter. However, laparoscopic surgery requires special instrumentation and training. Our modified procedure can be performed in less-well equipped operating rooms where most LP shunt procedures are conducted. We are evaluating the efficiency and long-term usefulness of our method in a large cohort with long-term follow-up.

**References**


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