

Fibrous capsule formation of the peritoneal catheter tip in ventriculoperitoneal shunt: Two case reports

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Abstract

Background: A fibrous capsule formation of a peritoneal catheter tip has not previously been researched as a complication of ventriculoperitoneal (VP) shunts.

Case Description: Two adult patients who had undergone a VP shunt for communicative hydrocephalus following subarachnoid hemorrhage caused by a ruptured aneurysm have been identified with malfunction of the VP shunt system by mild disturbance of consciousness and gait disturbance or loss of appetite. Hydrocephalus was diagnosed by computed tomography and the obstruction of the peritoneal catheter was revealed by shuntgraphy. Laparoscopy was performed and the peritoneal catheter tips were obstructed by fibrous white capsules that covered them. One was a thin membranous capsule like a stocking with two small endoluminal granulomas of the peritoneal catheter, and other one was a fibrous glossy white capsule like a sock. These fibrous capsules were excised by laparoscopy forceps without the conversion to a new peritoneal catheter. Following the procedure, the shunt functioned normally. The pathological diagnoses were peritoneum with foreign body reaction or hyalinization of membranous tissue surrounded by fibrous tissue.

Conclusion: These fibrous capsules might be formed by the peritoneal reaction to cerebrospinal fluid as a foreign material. As such, a periodic medical check should be scheduled since a fibrous capsule of the peritoneal catheter tip might be formed again.

Key words: Fibrous capsule, hydrocephalus, laparoscopy, peritoneal catheter, ventriculoperitoneal shunt

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INTRODUCTION

Ventriculoperitoneal (VP) shunt has been a standard procedure to treat hydrocephalus. And unusual peritoneal complications can result, including an abdominal cyst or a pseudocyst^[2,4,5,7,8,12] that usually causes signs and symptoms of intraabdominal abnormalities especially in babies or infants. However, a fibrous capsule formation of

a peritoneal catheter tip has not been researched as one of peritoneal complications. Herein, the author reports two adult cases in which the peritoneal end of the catheters were obstructed by fibrous white capsules covering them like a stocking or a sock under the laparoscope. Furthermore these capsules were pathologically examined and the potential mechanism of capsule formation was discussed.

CASE REPORT

Case 1

A 48-year-old male patient had undergone VP shunt for hydrocephalus caused by subarachnoid hemorrhage on May 16, 2012. In the VP shunt procedure, laparoscopic placement of the peritoneal catheter (Peritoneal Catheter with BioGlide®, Standard, Barium Stripe, Open Ended with 8 Wall Slits, 90 cm; Medtronic, Inc. Minneapolis, USA) into the peritoneal cavity was performed. Five months later, he presented with mild disturbance of consciousness and gait disturbance in October 2012. Hydrocephalus was diagnosed by computed tomography (CT) [Figure 1a] and the malfunction of VP shunt due to the obstruction of the peritoneal catheter was revealed by shuntgraphy [Figure 1b]. Laparoscopy was performed and the peritoneal end of the catheter was obstructed by a fibrous white capsule, which covered

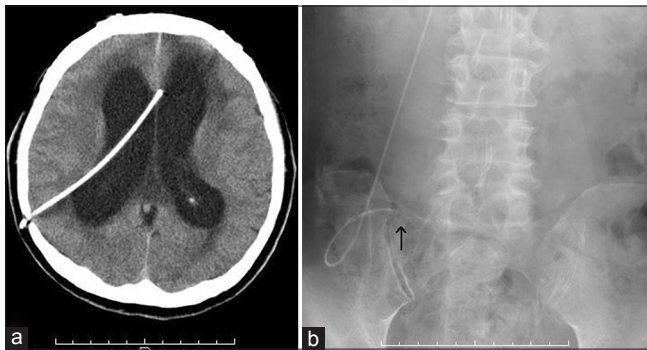


Figure 1: (a) Computed tomography (CT) on admission revealing the dilatation of bilateral ventricles and the bilateral periventricular lucency (b) Shuntgraph revealing the peritoneal catheter tip (arrow) was obstructed

it like a stocking [Figure 2a, b]. This capsule with two small endoluminal granulomas of the peritoneal catheter was excised by laparoscopy forceps without the exchange of a new peritoneal catheter [Figure 2c-e]. Following this procedure, the VP shunt functioned normally. The patient was discharged on January 30, 2013. This capsule was pathologically diagnosed peritoneum with foreign body reaction [Figure 3a].

Case 2

A 74-year-old female patient had undergone VP shunt for hydrocephalus caused by subarachnoid hemorrhage at the age of 43. And 20 years later, the total shunt system was replaced because of the shunt malfunction. In the second revision of the VP shunt, the peritoneal catheter (Peritoneal Catheter with BioGlide®, Standard, Barium Stripe, Open Ended with 8 Wall Slits, 90 cm; Medtronic, Inc. Minneapolis, USA) was inserted into the peritoneal cavity via a small laparotomy. Eleven years later, she has presented mild disturbance of consciousness and loss of appetite since February 10, 2013. On admission, hydrocephalus was diagnosed by CT and the malfunction of VP shunt due to the obstruction of the peritoneal catheter was revealed by shuntgraphy. Laparoscopy was performed and the peritoneal end of the catheter was obstructed by a fibrous glossy white capsule, which covered it like a sock [Figure 2f]. Even though partial peritoneum was adhered, this fibrous capsule was excised by laparoscopy forceps without the exchange of a new peritoneal catheter [Figure 2g]. Following this procedure, the VP shunt also functioned normally. This capsule was pathologically diagnosed hyalinization of membranous tissue surrounded by fibrous tissue [Figure 3b]. No obstruction of the peritoneal catheter occurred over about half and one year follow-up.

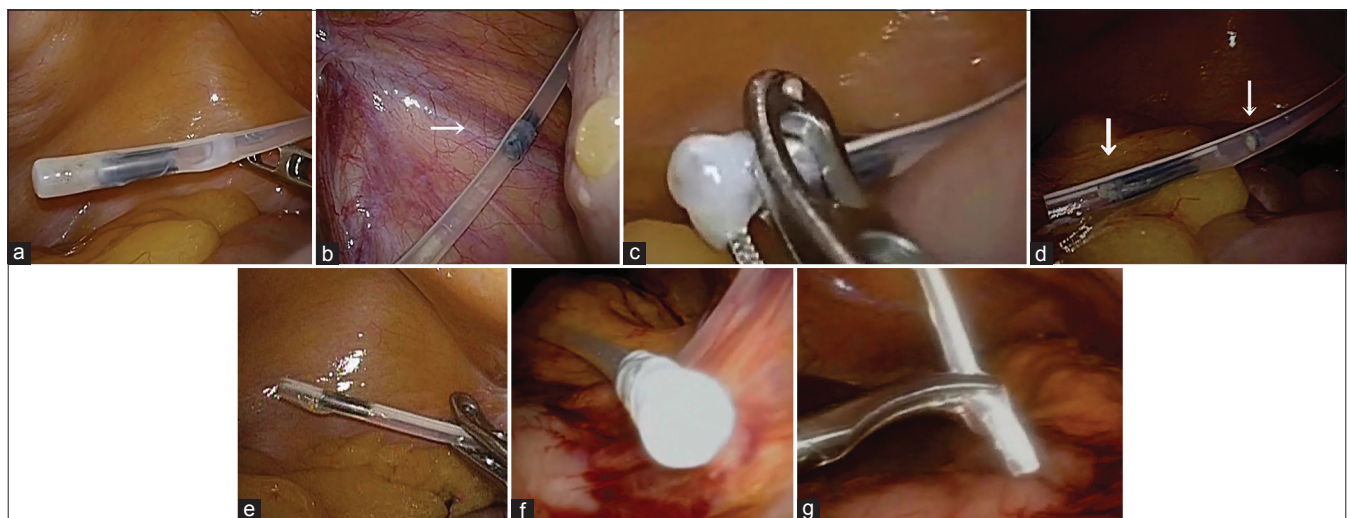


Figure 2: (a) The peritoneal catheter tip was obstructed by a fibrous capsule like a thin membranous stocking. (b) The fibrous capsule was formed from the proximal slit (arrow) to the tip of the peritoneal catheter. (c) The white fibrous capsule was stripped off by laparoscopy forceps. (d) Two pieces of intraluminal granulomas (arrows), (e) Colorless clear cerebrospinal fluid (CSF) flowed out after the removal of the fibrous capsule. (f) The white fibrous capsule like a sock of the peritoneal catheter tip. (g) Colorless clear CSF flowed out after the removal of the fibrous capsule

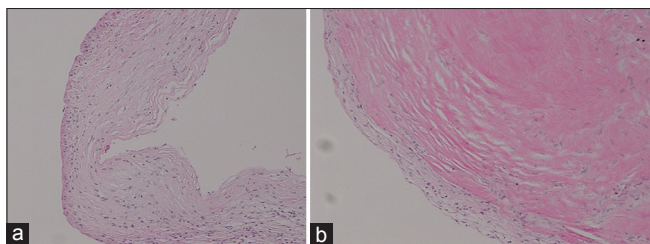


Figure 3: (a) Photomicrograph of the surgical specimen in case 1 showing peritoneal tissue composed by a layer of mesothelium cells and fibrous tissue. (H and E, x200) (b) Photomicrograph of the surgical specimen in case 2 showing hyalinization of membranous tissue surrounded by fibrous tissue. (H and E, x400)

DISCUSSION

Fibrous capsule formation of the peritoneal end of the tube was first described in 1954.^[10] However, the precise difference between fibrous capsule and cyst was not pointed out. Later, fibrous encasement of the peritoneal catheter tip was described as one of the causes of shunt malfunction in 1983.^[1] Terminology of fibrous capsule has been inconsistent, besides fibrous capsule or encasement has not been researched and not been known well.

An abdominal cyst or a pseudocyst as an unusual peritoneal complication of VP shunt usually causes signs and symptoms of intraabdominal abnormalities in babies or infants.^[2,4,5,7,8,12] However, fibrous capsules of the peritoneal catheter tip in two cases caused hydrocephalus without signs and symptoms of intraabdominal abnormalities. Therefore, regarding clinical features, such fibrous capsules should be discriminated from an intraabdominal cyst or a pseudocyst.

Occlusion of the peritoneal catheter tip was reported to appear in 9.5% among abdominal complications in VP shunts, even though cerebrospinal fluid (CSF) loculation or cyst formation appeared in 1.7%.^[1] Such a fibrous capsule is supposed to be one of the causes of the occlusion of the peritoneal catheter. Without laparoscopy-assisted surgery, such a fibrous capsule could not be found out. Even though only a baby case of the fibrous capsule^[10] was previously described, such a fibrous capsule formation might be more common in the case of occlusion of the peritoneal catheter tip.

Pathological diagnoses of two fibrous capsules are peritoneum with foreign body reaction or hyalinization of membranous tissue surrounded by fibrous tissue. An abdominal cyst or a pseudocyst has been pathologically reported to be a thick or thin-walled fibrous tissue infiltrated by inflammatory cells.^[2,8,12] It reveals that fibrous capsules like a stocking or a sock are different from an abdominal cyst or a pseudocyst. The surface appearance of the fibrous capsule in case 2 especially

looked like cocooned peritoneum in sclerosing encapsulating peritonitis (SEP), which was caused by chronic continuous ambulatory peritoneal dialysis.^[3,6] In fact, two cases of SEP were reported to be caused in the VP shunt.^[11] Therefore, a fibrous capsule might be related to SEP.

An intraabdominal cyst or a pseudocyst is supposed to be caused by frequent peritoneal infections or multiple laparotomies by shunt revisions.^[2,8,12] The fibrous capsule in case 1 was formed only 6 months after the first VP shunt without peritonitis. The fibrous capsule in case 2 was also formed 11 years after the second revision of the VP shunt without peritonitis. A previously described fibrous capsule in a baby^[10] was formed 2.5 years after the first shunt surgery without peritonitis. According to three cases, fibrous capsules were not related to frequent peritonitis or frequent laparotomies by shunt revisions. SEP is supposed to be caused by hyperosmolar unphysiological irrigation fluid.^[3,6] Three fibrous capsules like a stocking or a sock were formed at the tip of the peritoneal catheter, and especially fibrous capsule in case 1 was formed from the proximal slit of the peritoneal catheter. So such a fibrous capsule is suspected to be formed by the peritoneal reaction to CSF as an unphysiological fluid in the peritoneal cavity.

There was a difference between two fibrous capsules in cases 1 and 2. One was a thin membranous capsule like a stocking, and the other was a fibrous glossy white capsule like a sock. According to the pathological features, a thin membranous capsule like a stocking in case 1 would turn into a fibrous glossy white capsule like a sock in case 2, since hyalinization could cause such degeneration. And the difference between two types of capsules might be caused by the difference of the length of the peritoneal catheter exposed to CSF.

Laparoscopy can offer several advantages in placement of a peritoneal catheter. With use of a laparoscope, the entire abdominal cavity can be visualized and the cause of malfunction of a peritoneal catheter can be precisely revealed.^[9] Use of a laparoscope rather than repeated laparotomy could avoid peritoneal adhesions within the abdominal cavity. Previous reports describing encystation of the tip of the peritoneal catheter have recommended complete removal of the peritoneal catheter with conversion to a new shunt system.^[2,8,12] However, use of a laparoscope was so minimally invasive that VP shunt system could function normally without conversion to a new peritoneal catheter following the removal of the fibrous capsule in two cases. Since a fibrous capsule of a peritoneal catheter tip might be reformed again, periodic long-term follow-up (medical check) should be scheduled. And with use of a laparoscope, further research for it is needed.

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