

Case Report

Fibrous encapsulation of the peritoneal catheter in peritoneal shunt: Case report

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Abstract

Background: The authors report a case of fibrous encapsulation of the peritoneal catheter, which caused peritoneal shunt malfunction, and has not previously been researched well as a complication of peritoneal shunts.

Case Description: A 69-year-old woman who had undergone a lumboperitoneal (LP) shunt for communicative hydrocephalus following subarachnoid hemorrhage caused by a ruptured aneurysm was identified with malfunction of the LP shunt system by dementia and gait disturbance. Hydrocephalus was revealed on computed tomography (CT). Under a laparoscopy, the intraabdominal peritoneal catheter was observed to be obstructed by fibrous encapsulation covering it like a long white stocking. Although the fibrous encapsulating tissue was excised by laparoscopy forceps, a ventriculoperitoneal shunt device was replaced with a new peritoneal catheter. The histopathological diagnosis of the surgically resected encapsulating tissue was the fibrous tissue with a few inflammation cells and a layer of lining cells surrounding some part of it. In the immunohistochemical study, a layer of lining cells surrounding the fibrous tissue showed immunohistochemically positive staining for calretinin.

Conclusion: The fibrous encapsulation would be formed by peritoneal reaction to a peritoneal catheter as a foreign body by these histopathological and immunohistochemical analyses.

Key Words: Calretinin, fibrous encapsulation, laparoscopy, peritoneal catheter, peritoneal shunt, shunt malfunction

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INTRODUCTION

Peritoneal shunt has been a standard procedure to treat hydrocephalus. Unusual peritoneal complications can occur, including an abdominal cyst or a pseudocyst that usually causes signs and symptoms of intraabdominal abnormalities, especially in babies or infants.^[3,9,10,13] However, a fibrous capsule^[6,12] or encapsulation of a peritoneal catheter has not been researched well as one of peritoneal complications. Herein, we report an adult case of fibrous encapsulation, which covered the intraabdominal peritoneal catheter like

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a long stocking and obstructed it under the laparoscope. Furthermore, the fibrous encapsulating tissue was pathologically and immunohistochemically examined and the potential mechanism of encapsulation was discussed.

CASE HISTORY

A 69-year-old woman had undergone lumboperitoneal shunt (LP) shunt for hydrocephalus caused by subarachnoid hemorrhage on January 14, 2016. During the LP 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. Following LP shunt, symptoms caused by hydrocephalus in the patient disappeared. Three months later, she presented with dementia and gait disturbance in April, 2016. Hydrocephalus was diagnosed by computed tomography (CT) [Figure 1a]. LP shunt malfunction caused by obstruction of the peritoneal catheter was suspected. Although obvious obstruction of the peritoneal catheter could not be found by shuntgraphy, laparoscopy-assisted surgery was performed, and the intraabdominal peritoneal catheter was obstructed by a fibrous encapsulating tissue, which covered it like a long stocking [Figure 2a-c]. This encapsulating tissue of the peritoneal catheter was excised by laparoscopy forceps [Figure 2d]. However, this peritoneal catheter was too short to be connected to a VP shunt valve on the skull, and a new peritoneal catheter was replaced into peritoneal cavity. Following VP shunt, the size of lateral ventricles became normal [Figure 1b] and the patient discharged without its neurological signs and symptoms on May 10, 2016. . The histopathological diagnosis of this encapsulating tissue was the fibrous tissue with a few inflammation cells [Figure 3a]. Moreover, some parts of this fibrous tissue were surrounded by a layer of

lining cells that showed immunohistochemically positive staining for calretinin [Figure 3b]. Therefore, the fibrous encapsulation obstructing the intraabdominal peritoneal catheter would be caused by foreign body reaction of peritoneum to a peritoneal catheter as a foreign body.

DISCUSSION

Fibrous capsule formation of the end of a peritoneal catheter, which covered it like a stocking was first described in 1954 [Table 1].^[12] However, the precise difference between fibrous capsule and cyst was not pointed out. Later, the blockage of the tube within the abdominal cavity by either omentum or scar tissue was reported in 1955.^[4] Fibrous encasement of the peritoneal catheter tip was described as one of the causes of shunt malfunction in 1983.^[1] Under a laparoscope, the tip of the distal catheter ensheathed by adhesions and scar tissue was also observed and reported in 2007.^[5] With the use of laparoscope, the author reported two cases of fibrous capsule formation of distal or end of a peritoneal catheter, which caused peritoneal shunt failure of VP shunts.^[6] Furthermore, the fibrous encapsulation covering and obstruction of the intraabdominal peritoneal catheter is described in this case report. While the fibrous capsules cover a peritoneal catheter tip or its end like a stocking or sox [Figure 4a and b], the fibrous encapsulation completely covers an intraabdominal peritoneal catheter like a long white stocking [Figure 2d]. However, fibrous capsule, encapsulation, scar tissue blockage, or fibrous encasement has not been researched well and still remains unknown.

A fibrous encapsulation or capsule covering the peritoneal catheter like a long stocking or sox obstructed

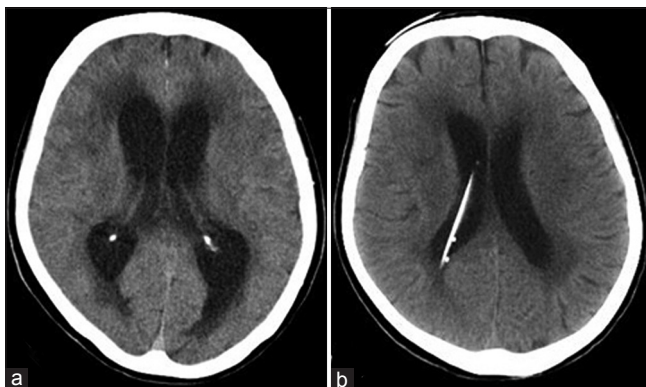


Figure 1: (a) CT on admission revealing the dilatation of bilateral ventricles and the bilateral periventricular lucency. (b) Postoperative CT revealing the size of bilateral ventricles was normalized and bilateral periventricular lucency disappeared after ventriculoperitoneal shunt

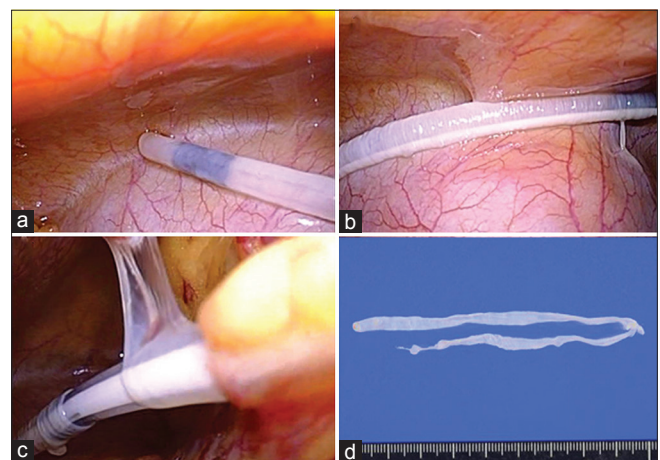


Figure 2: (a) The distal side of the peritoneal catheter is obstructed by a fibrous encapsulating tissue covering it like a long stocking. (b) The fibrous encapsulation covers the intraabdominal peritoneal catheter from the middle part of it to the distal side of it. (c) The fibrous encapsulating tissue disconnects with a fibrous tissue at the orifice of peritoneal cavity. (d) The fibrous encapsulating tissue is about 16cm long and it looks like a long white stocking

a peritoneal catheter and caused hydrocephalus without signs and symptoms of intraabdominal abnormalities. On the other hand, the obstruction of distal catheter tip ensheathed by adhesions and scar tissue also caused hydrocephalus without abdominal complications.^[5] Even though both of them caused obstruction of a peritoneal catheter, the adhesions and scar tissue were completely different from the fibrous capsules and encapsulation because they did not cover a peritoneal catheter like a stocking or sox under the laparoscope.

An abdominal cyst or a pseudocyst as an unusual peritoneal shunt complication usually has signs and symptoms of intraabdominal abnormalities in babies or infants.^[3,9,10,13] They are supposed to be caused by

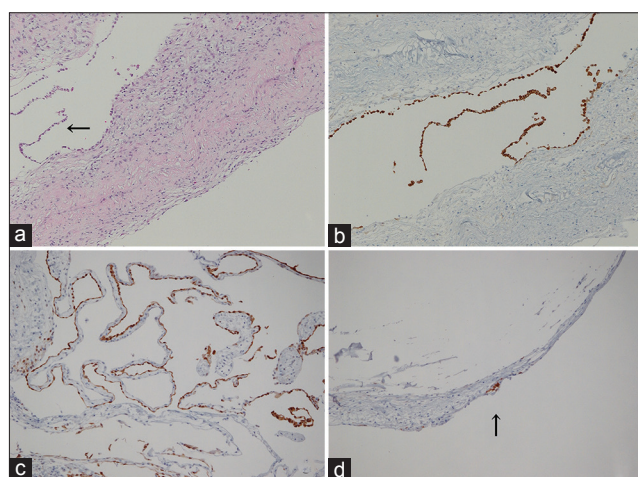


Figure 3: (a) Photomicrograph of the surgical specimen shows fibrous tissue with a few inflammatory cells. And it is covered with a layer of cells suspected to be mesothelium cells (←). Hematoxylin and eosin stain, original magnification $\times 200$. (b) Immunohistochemical examination revealing that a layer of cells suspected to be mesothelium shows positive staining for calretinin in the current case. Immunohistochemical examination revealing that a layer of lining cells (c) and a few surface cells (↑) (d) also show positive staining for calretinin in previously reported fibrous capsule cases

frequent peritoneal infections or multiple laparotomies by shunt revisions.^[3,10,13] In addition, they have been pathologically reported to be a thick or thin-walled fibrous tissue infiltrated by inflammatory cells.^[3,10,13] However, the fibrous encapsulation of the current case or the fibrous capsules reported by the author^[6] were not related to frequent peritonitis or frequent laparotomies by shunt revisions [Table 1]. Furthermore, the fibrous encapsulation or fibrous capsules did not show such an inflammation in pathological study. From the clinical and histopathological features, the fibrous capsules and encapsulation are completely different from an abdominal cyst or pseudocyst, and should be discriminated from them.

The histopathological feature of the fibrous encapsulating tissue in the current case is a fibrous tissue with a few inflammatory cells, and some part of it are covered with a layer of lining cells supposed to be mesothelium cells [Figure 3a]. In addition, a layer of lining cells shows immunohistochemically positive staining for calretinin,^[2,8]

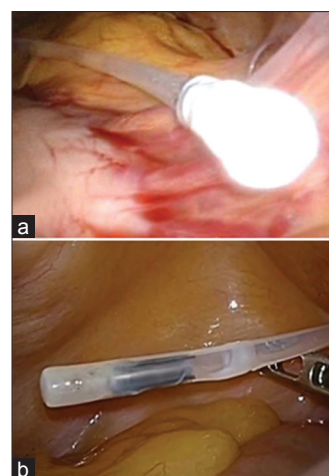


Figure 4: A white fibrous capsule like a sox (a) and a thin membranous fibrous capsule like a stocking (b) cover the end of the peritoneal catheter in the previously reported cases

Table 1: Cases of fibrous capsule or encapsulation of a peritoneal catheter

Authors/year	Age (yrs)/Sex	Macroscopic appearance	Histopathological findings	Immunohistochemical findings	Cause of symptoms	Abdominal complication	Duration of onset from shunt	Times of peritoneal shunt
Scott <i>et al.</i> /1955	less than 3/NDR	Fibrous capsule Like a stocking	NDR	NDR	Hydrocephalus	none	2.5 years	1
Kano/2014	48/male	Fibrous capsule Like a stocking	Fibrous tissue with mesothelium cells	*Positive staining for Calretinin on mesothelium cells	Hydrocephalus	none	5 months	1
	74/female	Fibrous capsule like a white sox	hyalinization tissue with fibrous tissue	*Positive staining for Calretinin on a few mesothelium cells	Hydrocephalus	none	11 years	2
Present case	69/female	Fibrous encapsulation like a long white stocking	Fibrous tissue with mesothelium cells	Positive staining for Calretinin on mesothelium cells	Hydrocephalus	none	3 months	1

NDR: No date recorded *These dates are not described in the original report. These dates are first revealed in this report

which is expressed in normal mesothelium [Figure 3b], although Calretinin is expressed in several normal tissues and several tumors.^[2] One of the two fibrous capsules previously reported by the author^[6] revealed the same histopathological and immunohistochemical feature as the fibrous encapsulating tissue in the current case [Figure 3c]. Although other reported fibrous capsule cases showed hyalinized and degenerated tissue, they also involved a few cells that were immunohistochemically positive for calretinin [Figure 3d]. Therefore, there would be a causal relation between fibrous capsule or encapsulation and peritoneum.

Interestingly, fibrous tissue at the orifice of the peritoneal cavity does not connect with fibrous encapsulating tissue [Figure 2d]. However, it might be possible that the fibrous encapsulating tissue would be broken and move to a distal side of peritoneal catheter by shuntgraphy, in which contrast medium was injected into a peritoneal catheter with relatively high pressure. The fibrous encapsulating tissue would entirely cover an intraabdominal peritoneal catheter in an abdominal cavity and connect with peritoneum at the orifice of abdominal cavity under a laparoscope. Peritoneal membrane may encapsulate a peritoneal catheter as a foreign body to protect peritoneal cavity. The fibrous encapsulating tissue might be broken, diminished in size, and turned into fibrous capsules because the results of histological and immunohistochemical investigations are almost the same.

The encapsulation of this current case was formed for only 3 months following LP shunt. One of the previously reported fibrous capsules was also formed for 5 months following VP shunt [Table 1]. Although the other case of fibrous capsules was formed 11 years after VP shunt revision, this fibrous capsule had already been degenerated in its histological feature. Fibrous encapsulation or capsule might be formed soon after peritoneal shunt.

Occlusion of the peritoneal catheter tip was reported to appear in 9.5% of the cases among abdominal complications in VP shunt, even though CSF loculation or cyst formation appeared in 1.7%.^[1] Such a fibrous capsule or encapsulation could not be found out without laparoscopy-assisted surgery. Such a fibrous capsule or encapsulation might be more common in the case of occlusion of the peritoneal catheter.

CONCLUSION

In conclusion, the fibrous encapsulation or capsule would be formed by peritoneal reaction to the

peritoneal catheter as a foreign material according to the histopathological and immunohistochemical analyses. The fibrous encapsulating tissue would turn into a fibrous capsule. Laparoscopy can offer several advantages in placement or observation of a peritoneal catheter into peritoneal cavity.^[7] Especially, with use of a laparoscope, the cause of malfunction of a peritoneal catheter can be precisely revealed.^[11] Fibrous encapsulation is one of the causes of the occlusion of the peritoneal catheter. Because a fibrous encapsulation of a peritoneal catheter might be reformed again, periodic long-term follow-up medical check should be scheduled. Regarding the use of a laparoscope, further research is needed.

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Conflicts of interest

There are no conflicts of interest.

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