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## Single Case

# Acute Small Bowel Perforation Caused by Obstruction of a Novel Tag-Less Agile™ Patency Capsule

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## Keywords

Patency capsule · Capsule endoscopy · Small bowel perforation

## Abstract

A 74-year-old man visited our hospital complaining of abdominal pain. An abdominal computed tomography scan showed multiple wall thickness of the small bowel. Capsule endoscopy was recommended for further evaluation, and patency capsule examination was performed. Eighteen hours after patency capsule ingestion, he experienced small bowel perforation with severe peritonitis caused by intestinal pressure rising because of the patency capsule trapped in his terminal ileum. An ileocolic resection was performed, including the removal of the sclerotic ileum as an emergency surgery. A pathological examination showed transmural inflammation and multiple ulcers with perforation of the small intestine, consistent with Crohn's disease. Here, we report a rare and valuable case of novel tag-less Agile™ patency capsule (Given Imaging Ltd., Yoqneam, Israel) retention leading to small bowel perforation.

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## Introduction

Capsule endoscopy is an important tool for minimally invasive evaluation of the small intestine and is generally a safe examination. There are, however, a few complications [1]. Capsule retention is the most serious complication because it may lead to intestinal obstruction or perforation, its frequency ranging from 0% in healthy patients to 21% in patients with small bowel stricture [2]. The patency capsule can be useful in evaluating the small bowel stenosis prior to capsule endoscopy. The patency capsule is made of a lactose capsule and barium sulfate. When blocked by a stenosis, the patency capsule dissolves 30 h after ingestion and passes through the stenosis. However, the patency capsule itself has also been shown to result in symptomatic small bowel obstruction, in a few recent cases [3–5]. Here, we report a rare and valuable case of novel tag-less Agile™ patency capsule retention leading to mechanical obstruction and small bowel perforation.

## Case Report

A 74-year-old man with hypertension, old cerebral infarction, and alcoholic liver disease was referred to our hospital for intermittent abdominal pain around the navel. A physical examination revealed tension of the abdominal wall. His body temperature was 36.6 °C and weight and height were 71 kg and 166 cm, respectively. Laboratory results indicated the following: hemoglobin 10.7 g/dL, white blood cells 8,200/μL, C-reactive protein 0.89 mg/dL, and albumin 2.4 g/dL. Results from a kidney function test and clotting function examination were within the normal range. His history revealed that at the age of 71, he had been hospitalized for suspected infectious enteritis, as an abdominal computed tomography (CT) scan showed multiple wall thickness of the ileum. Because treatment with antibiotics proved successful, a close examination was not performed at that time. Though esophagogastroduodenoscopy results were unremarkable at this time, an abdominal CT scan showed the same observation previously (Fig. 1). For further evaluation of the small bowel, capsule endoscopy was recommended.

The patient ingested a novel tag-less Agile™ patency capsule (Given Imaging Ltd., Yoqneam, Israel) for the evaluation of intestinal stenosis prior to capsule endoscopy. Eighteen hours after ingestion, he was referred to our hospital because of progressive abdominal distention and worsening terrible abdominal pain. The physical examination revealed marked tenderness. Laboratory tests indicated a white blood cell count of 25,000/μL. A CT scan showed the patency capsule trapped in his terminal ileum and intraperitoneal air (Fig. 2). Emergent surgery was performed. During the surgical exploration, an ileum perforation was found proximal to the stricture of the terminal ileum in which the patency capsule was impacted (Fig. 3). The sclerotic change of the ileum was recognized at 100-cm length from the ileocecal valve. An ileocolic resection, including the removal of the sclerotic ileum, was performed at this time (Fig. 4). Pathological examination of the surgical specimen showed transmural inflammation and multiple ulcers with perforation of the small intestine, consistent with Crohn's disease. Following the operation, the condition of the patient's Crohn's disease has improved and is well controlled with drug therapy.

## Discussion

Successful evaluation of the small bowel has been considered technically difficult for a long time because of many anatomical and physiological reasons. Balloon-assisted endoscopy and capsule endoscopy have enabled physicians to observe small bowel diseases, such as Crohn's disease, obscure gastrointestinal bleeding, intestinal tumors, and drug-induced small bowel mucosal damage, and assist with the surveillance of polyposis syndrome. Balloon-assisted endoscopy can also be used to perform an endoscopic tissue sampling and treatments including hemostasis, balloon dilation, and polyp resection. However, sedation is required, and major complications (e.g., perforation, pancreatitis, bleeding, and aspiration pneumonia) have been reported [6].

Capsule endoscopy is minimally invasive and generally safe. Total observation rate is relatively high, and capsule endoscopy is useful as a means to detect the way of retrograde or antegrade double balloon endoscopy insertion. There are, however, a few complications. Capsule retention is the most serious complication because it may lead to intestinal obstruction or perforation, its frequency ranging from 0% in healthy patients to 21% in patients with small bowel stricture [2].

The patency capsule is useful to ensure the presence of small bowel stenosis prior to capsule endoscopy [7]. The patency capsule is made of a lactose capsule and barium sulfate, which makes the capsule radiopaque. When blocked by a stenosis, the patency capsule dissolves 30 h after ingestion and passes through the stenosis. In the absence of stenosis, it is excreted before the dissolution. First-generation patency capsules have a single timer plug and a radiofrequency identification (RFID) tag. The RFID tag enables physicians to confirm the location of patency capsule by using an RFID tag scanner, which does not lead to radiation exposure. However, first-generation patency capsules may cause retention leading to timer plug impaction in the stricture because in some cases, the device does not dissolve readily [8, 9]. Therefore, newer second-generation patency capsule designs include an RFID tag and two timer plugs at each end to allow for easier penetration of the intestinal fluid. Kopylov et al. [10] reported 20 symptomatic cases of retention out of 1,615 second-generation patency capsule tests, with only 1 case requiring surgery. They also collected case series from the literature pertaining to the use of first- and second-generation patency capsules [10]. The pooled rate of patency capsule-related complications was 40/629 (6.3%), with only 3 patients who used first-generation patency capsules and two patients who used second-generation patency capsules requiring surgery. Most of the patients had Crohn's disease. Furthermore, Rasmussen et al. [11] reported a case of second-generation patency capsule retention, which induced a small bowel perforation.

In Japan, the novel tag-less Agile™ patency capsule (Given Imaging Ltd.), which is an RFID tag-free system with two timer plugs, was introduced because Garg et al. [12] reported that the RFID tag affected the stenosis, causing small bowel ileus. Nakamura et al. [13] reported the clinical usefulness of the novel tag-less Agile™ patency capsule prior to capsule endoscopy in patients with suspected small bowel stenosis. To date, there has been no report of capsule endoscopy retention confirmed via novel tag-less Agile™ patency capsule evaluation. However, it has also been shown to result in symptomatic small bowel obstruction in several recently reported cases [3–5]. In the case we have reported, 18 h after novel tag-less Agile™ patency capsule ingestion, the patency capsule trapped in his terminal ileum. Intestinal obstruction caused intestinal pressure to rise, resulting in intestinal perforation. Although we think that our case is a rare case of novel tag-less Agile™ patency capsule retention leading to small bowel perforation, it might be possible to avoid such adverse events by adapting the

patency capsule test and capsule endoscopy. Saito et al. [5] reported that if CT or MRI reveals the presence of prestenotic dilatation, bulky tumor, or multiple stenosis, we should avoid patency capsule test and capsule endoscopy, and we perform a detailed examination by balloon-assisted endoscopy.

Nakano et al. [4] reported the usefulness of transabdominal ultrasonography prior to patency capsule use in a patient with suspected small bowel strictures as a means to avoid unnecessary patency capsule examination. He classified transabdominal ultrasonography findings as follows: type A, or intestinal narrowing and distension at the oral side; type B, or extensive bowel wall thickening; type C, or focal bowel wall thickening; or type D, in which no abnormality was detected. The researchers also concluded that patients with type A findings and Crohn's disease patients with type B findings had a high risk of patency capsule retention and should not undergo patency capsule or capsule endoscopy examination. Non-Crohn's disease patients with type B findings or patients with type C or type D findings are able to undergo capsule endoscopy after a patency capsule evaluation [4]. Another study by Rozendorn et al. [14] reported the effectiveness of magnetic resonance imaging for predicting patency capsule retention. They concluded that prestenotic dilatations and stenosis lengths with a mean of 9.7 cm were significantly correlated with patency capsule retention.

In conclusion, we report a very rare and valuable case of patency capsule retention that led to a small bowel perforation. If we suspect Crohn's disease, ileocolonoscopy and cross-sectional imaging will take precedence generally. We should avoid patency capsule test and capsule endoscopy in case of suspected Crohn's disease with abdominal pain, and the cross-sectional imaging reveals the presence of prestenotic dilatation, bulky tumor, or long stenosis. Although patency capsule evaluation is a very useful and safe examination in general, we should pay more attention to the possible complications of patency capsule use, especially in patients with Crohn's disease.

### Statement of Ethics

The authors have no ethical conflicts to disclose.

### Disclosure Statement

The authors have no conflicts of interest to disclose.

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**Fig. 1.** An abdominal CT scan showing multiple wall thickness of the patient’s ileum.





**Fig. 2.** a An abdominal CT scan showing the trapped patency capsule in the patient's terminal ileum (arrow). b, c An abdominal CT scan showing the spreading of free air.



**Fig. 3.** The patency capsule was impacted in the stenotic ileocecal valve.



**Fig. 4.** The sclerotic change of the ileum was seen over 100 cm, and perforation was recognized as located 25 cm from the ileocecal valve (arrow).