

# Tracheal Aspiration of a Capsule Endoscope: A New Case Report and Literature Compilation of an Increasingly Reported Complication

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this type of complication which have been described in the literature.

## Introduction

Video capsule endoscopy has been hailed a major breakthrough in endoscopic exploration of the small intestine and has become the diagnostic technique of choice in the etiological study of anemia and digestive hemorrhaging of unknown origin. It involves a technically simple and safe intervention which is absolutely contraindicated only if there is clinical or radiological evidence of intestinal obstruction, Zenker's diverticulum, or active Crohn's disease of the small intestine, or in children under ten years old. In this respect, the main complications described relating to video capsule endoscopy are failure to move along the gastrointestinal tract or capsule retention (consensually defined if a capsule remains in the bowel for a minimum of two weeks, or even permanently, unless extracted surgically or endoscopically) [1]. Swallowing disorders have also been suggested as being an important reason for contraindication, because of the potential risk of accidental aspiration of the capsule into the airway [2]. In this article, we present a case of video capsule aspiration which was resolved spontaneously and review the cases of

## Case Report

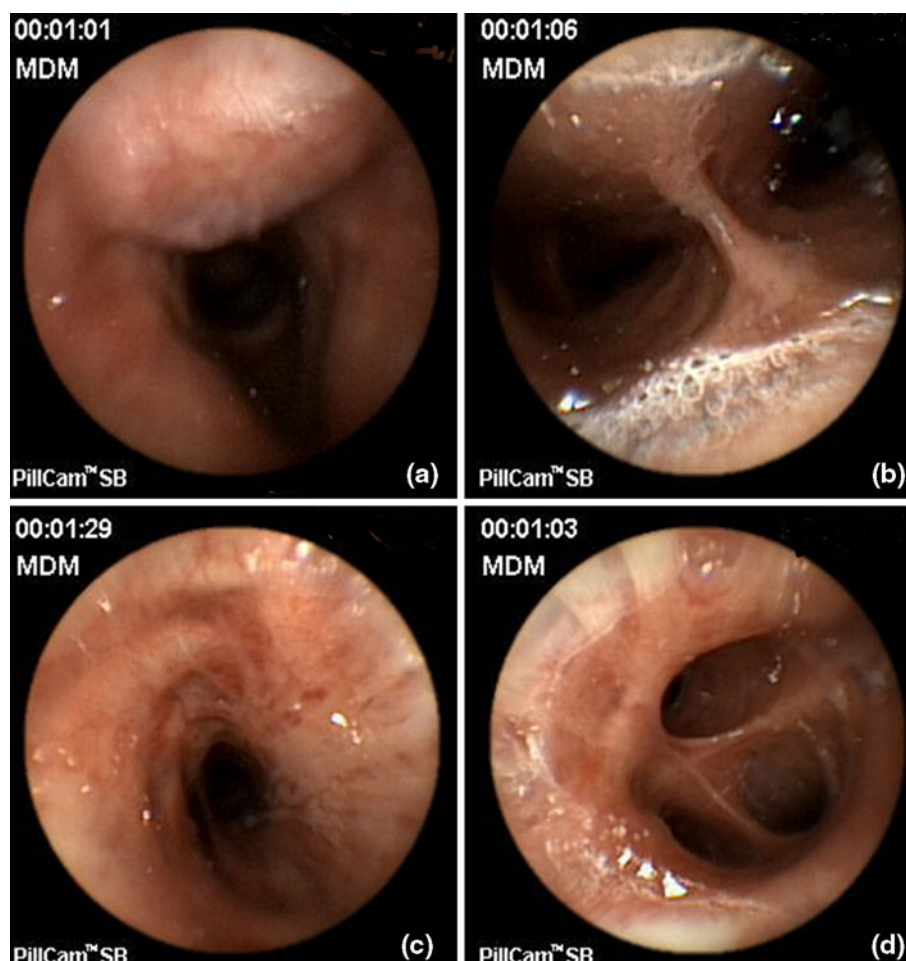
An 80-year-old male with advanced Parkinson's disease was examined for chronic ferropenic anemia (hemoglobin 10.7 mg/dL, hematocrit 36.4%, MCV 76 fL, iron 14 mcg/dL, ferritin 11 ng/mL) and a positive fecal occult blood test. His medical history most notably included smoking, diabetes mellitus, and advanced Parkinson's disease, with shaking, and with walking and speaking difficulties, but dysphagia was not reported with regard to solids or liquids. Gastroscopy, colonoscopy, and barium small-bowel follow-through did not detect any lesions to justify the clinical symptoms. A video capsule endoscopy was therefore scheduled (Pillcam SB; Given Imaging, Yoqneam, Israel), and performed on the patient whilst standing in the presence of a doctor. The patient found it difficult to swallow the capsule and made several attempts by taking small sips of water directly from a glass as he found it difficult to use a straw. He immediately started to cough persistently and had transitory breathing difficulties which improved after the bout of coughing subsided. The patient recovered quickly without any problem and left the clinic. No incidents occurred during the exploration and the device was removed 8 h later.

The first images from the exploration showed the glottis, followed by a ringed duct with an orange surface (Fig. 1a), the lower end of which forked into two round narrower ducts corresponding to the main bronchi. The dome of the capsule made contact with the carina (Fig. 1b) and the exits of the upper left (Fig. 1c) and right lobar bronchi (Fig. 1d) were even visible. The capsule remained in the airways for

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**Fig. 1** **a** Video capsule endoscopy image obtained at glottis level, showing the epiglottis, in the upper part and the tracheal duct behind the open airway entrance. **b** An endoscopic view of the carina. **c** Main left bronchi detail. **d** Panoramic view through the main right bronchi, where secondary bronchial tubes can be observed



approximately 20s and images of the esophagus and stomach then appeared. The exploration showed esophageal peptic erosion and an ileal ulcer as possible causes of anemia.

## Discussion

Video capsule endoscopy is a very safe diagnostic procedure, enabling thorough assessment of the small intestine in a larger series of patients compared with other endoscopic techniques [3]. The main complications reported are obstacles to the passage of the capsule along the digestive tract—a risk estimated to occur in 1% of explorations [4]—and it is contraindicated if there is evidence or suspicion of stenosis or intestinal diverticula. Retention of the capsule in the most proximal portion of the esophagus, impaction in a Zenker's diverticulum [5], and impaction of the cricopharyngeal muscle [6] which required endoscopic intervention have also been described. In recent years, another type of complication involving accidental aspiration of the capsule into the upper airways has also been

reported. This complication has been described in 11 other published case reports and in a review of a large number of endoscopic studies (Table 1), but has not been systematically assessed in the literature.

One of the first studies of this complication reported only one case out of every 600 explorations performed [7] and a review of 733 studies using video capsule endoscopy also reported one case of aspiration into the airways [8]. By the time we observed this complication, a total of 136 video capsule endoscopy studies had been performed at our hospital. This complication, which is predominantly described in males, affects elderly patients (older than 65), who frequently have other associated pathologies. Old age itself is a risk factor for aspiration of food into the respiratory tree [9], as are taking central nervous system depressants, poor teeth, or neurological disorders. In some of the cases described, there was prior knowledge of swallowing difficulties and two patients were offered the possibility of having the capsule inserted into their stomachs via gastroscope, which they declined.

None of the documented cases reports had a fatal outcome, despite the potential danger posed by the aspiration

**Table 1** Reported cases of aspiration of a video capsule into the airways, with clinical information on the patients' medical histories, symptoms, and the methods used to resolve the problem

Ref.	Age and gender	Medical background	Reason for the exploration	History of dysphagia	Symptoms	Solutions	Completed GI test
Schneider AR et al. 2003 [24]	64, gender unknown	Mechanical mitral valve replacement	Anemia	Difficulty in swallowing the capsule	Recurrent coughing	Spontaneously after two minutes of coughing	Yes
Sinn I et al. 2004 [25]	69, female	Not available	Bleeding of obscure origin and anemia	No swallowing problems	Several coughing fits lasting about 1 min	Coughing	Yes
Tabib S et al. 2004 [7]	87, male	Resection of bladder cancer, heart disease, renal insufficiency	Iron deficiency anemia and positive fecal occult blood test	Normal swallowing in upper-GI barium contrast radiography	Asymptomatic, except for sensation of foreign bodies in throat	Removed by rigid bronchoscope	No
Buchkremer F et al. 2004 [11]	74, male	Ankylosing spondylitis involving cervical spine	Chronic diarrhea, anemia, weight loss, celiac disease	No symptoms of dysphagia	Mild respiratory distress while walking, two days after the capsule was administered	Removed from the right main bronchus by flexible bronchoscope	No
Rondonotti E et al. 2005 [8]	Not specified	Not available	Not available	No clinical or subclinical swallowing problems	No respiratory distress	Spontaneous expulsion of the capsule by coughing	Yes
Schiff AD et al. 2007 [23]	67, male	Hypertension, diabetes mellitus, cerebrovascular accident	Anemia, occult GI hemorrhage	Intermittent dysphagia	Dysphonia, persistent cough, ronchi, tachypnea, and tachycardia.	Removed using a rigid bronchoscope	No
Nathan SR et al. 2007 [26]	93, male	No significant medical history	Gastrointestinal bleeding of obscure origin	No significant swallowing difficulties	Minimal cough which abated after drinking water	Spontaneously rectified by coughing up some material and subsequently swallowing it.	Yes
Sepehr A et al. 2007 [22]	67, male	Hypertension, diabetes mellitus, cerebrovascular accident	Anemia, occult GI hemorrhage	No swallowing problems	Persistent cough and dysphonia	Removed using a rigid bronchoscope and an expandable basket foreign body retriever (Roth Net)	No
Guy T et al. 2009 [13]	90, male	Ischemic stroke	Melena complicated with anemia	Not specified	Asymptomatic	Removed by rigid bronchoscope	No
Leeds JS et al. 2009 [12]	85, male	Not available	Recurrent iron deficiency anemia	No history of dysphagia or conditions affecting pharyngeal sensation	Asymptomatic	The capsule fell on the ground and was retrieved. The patient denied coughing up the capsule	No
Bredenoord AJ et al. 2009 [16]	65, male	Ileal resection	Search for small bowel carcinoid tumors	Not specified	Lengthy swallowing attempt. Coughed up the capsule	Coughed up the capsule	Yes
Choi HS et al. 2010 [14]	75, male	Cerebrovascular accident five years earlier	Small bowel bleeding	No difficulty in swallowing and normal neurological examination	Patient coughed several times during swallowing. Asymptomatic	Removed by bronchoscopy, grasping the capsule with a Roth net after a cough was induced	No
Lucendo AJ (this case report)	80, male	Diabetes mellitus, advanced Parkinson's disease	Ferropenic anemia	No history of dysphagia	Persistent cough and short-lived breathing difficulties	Coughed repeatedly until the capsule was dislodged	Yes

of an instrument measuring 11 mm × 26 mm. The antero-posterior and transverse diameters of an adult trachea are 16 mm and 14 mm, respectively [10], and if the capsule is placed lengthways, there seems to be enough space to guarantee oxygenation of the patient. These differences in caliber could explain why in five reported cases of capsule aspiration into the airways [7, 11–14], the patients remained asymptomatic for hours until it was removed. However, coughing bouts were most commonly observed among the patients (in seven out of twelve cases, including our patient) which pushed the capsule (weighing only 3.7 g) towards the hypopharynx from where it could be swallowed while still providing images of its movement along the digestive tract in half of the cases, including our patient. If a video capsule remains asymptomatic inside the trachea, this could imply an anomaly of the patients' sensitivity to coughing, which might prevent them from generating the stimulus required to spontaneously expel the capsule; three asymptomatic patients had to undergo rigid bronchoscopy in order to remove the capsule from the trachea. Although no fatalities have been described, the fact that this complication has been reported on up to 12 different occasions means that preventive measures and treatment must be adopted to avoid fatal complications in the event of recurrence. Video capsule manufacturers recommend that they be used with caution in patients with known or potential swallowing disorders (<http://www.givenimaging.com>), but further precautions could be taken to avoid new cases of video capsule aspiration into the trachea: In addition to always administering the video capsule at the hospital, all medical histories should be questioned in relation to neurological or degenerative diseases and swallowing problems, even those of a minor nature. Patients with hypopharyngeal and esophageal motor disorders often have more difficulties swallowing liquids than solids; in such patients, a trial of drinking water could be performed before giving the patient a capsule endoscope to swallow. If the patient aspirates (as evidenced by coughing) or cannot swallow the water, this might identify a subset of patients at increased risk of capsule aspiration. In patients known to have swallowing disorders and with difficulties in swallowing the capsule after one or two attempts the video capsule should be placed in the duodenum with the aid of a gastroscope [15, 16], preferably using a capsule endoscopy delivery device [17]. The capsule may also be grasped with a polypectomy snare or with a foreign body-retrieval device (Roth net) [18, 19]. The use of an overtube to facilitate the delivery of the video capsule to the duodenum has also been described in the literature as an effective and safe method for patients with problems in swallowing the video capsule and with gastric outlet obstruction [20, 21], but this option would probably require systematic sedation for all patients. Transporting the video capsule inside a Roth net seems to be equally safe, preventing accidental aspiration of the device,

and does not require sedating the patients. For elderly patients or those with degenerative pathologies, and assuming the capsule can be located in real-time, another safety measure could be to perform a stomach scan on the patient before he or she leaves the clinic [22, 23].

If, after administration, the capsule is suspected to have been aspirated into the airways either because the patient is coughing repeatedly, has breathing difficulties or respiratory stridor, ensure that an additional oxygen supply is available and that an emergency radiological study is performed (fluoroscopy, chest X-rays, or CT scan) [7]. Some authors are concerned that it takes time to move the patient to the radiology room which can be dangerous for unstable patients, and, therefore, recommend downloading the video from the capsule endoscope as a novel, faster (takes less than 5 min), and more direct (photographs instead of X-rays) method of locating its position [18]. According to the literature, if tracheal location of the capsule is confirmed and the patient cannot dislodge it by coughing repeatedly, the most efficient method is to remove it by rigid [18, 19] or flexible [6] bronchoscopy. The smooth surface of the capsule and its length precludes removal with routine graspers and conventional forceps, and some authors have suggested that a Roth Net foreign bodies-retriever is useful for removing the capsule quickly and with minimum trauma [11].

## Conclusion

Aspiration of a video capsule into the upper airways is a complication of this technique which has been repeatedly documented and could occur in at least one out of every 800 explorations, especially with elderly patients. It should be suspected if the patient has a coughing bout immediately after swallowing the capsule, although it could occur without producing any symptoms. No fatalities have been reported but because of the potential seriousness of this complication, the appropriate preventive measures and treatment must be adopted, identifying the patients who are potentially at risk and placing the capsule directly in the duodenum using a gastroscope. If the capsule is aspirated and the patient cannot cough it up, the treatment of choice could be to remove it by bronchoscopy and with the aid of a Roth Net.

**Conflict of interest** Nothing to declare.

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