Post-Print: A Case of Magnetically Controlled Capsule Endoscopy Retention Caused by External Esophageal Compression Due to Cardiac Enlargement

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Abstract

Objective To analyze the clinical characteristics and auxiliary examination findings of patients with magnetically controlled capsule endoscopy retention due to esophageal stricture, and to investigate the causes of esophageal stricture in these patients. Methods Retrospective analysis of the clinical data of one patient with magnetically controlled capsule endoscopy retention due to esophageal stricture admitted to the Department of Gastroenterology, Fuwai Hospital, Chinese Academy of Medical Sciences. Results The patient was a 16-year-old female who presented with episodic chest tightness and dyspnea for one month. Past medical history was significant for dilated cardiomyopathy (highly probable). Imaging examinations revealed middle and upper esophageal stricture, significant cardiomegaly with predominant left heart enlargement. Conclusion Magnetically controlled capsule endoscopy retention due to esophageal stricture caused by cardiac enlargement compressing the esophagus is clinically rare. Esophageal foreign body retention poses significant risks to patients. Utilizing imaging examinations or patency capsule testing prior to the procedure can reduce the risk of magnetically controlled capsule endoscopy retention.

Full Text

One Case of Magnetically Controlled Capsule Endoscopy Retention Caused by External Esophageal Compression Due to Cardiac Enlargement

Abstract

Objective: To analyze the clinical characteristics and auxiliary examination findings of a patient with magnetically controlled capsule endoscopy (MCE)

retention caused by esophageal stenosis, and to investigate the underlying cause of the esophageal narrowing.

Methods: Clinical data of a patient with esophageal stenosis who was admitted to the Department of Gastroenterology at Fuwai Hospital, Chinese Academy of Medical Sciences, were retrospectively reviewed.

Results: A 16-year-old female patient presented with paroxysmal chest tightness and breathlessness for one month. She had a probable history of dilated cardiomyopathy. Imaging examinations revealed narrowing of the middle and upper esophagus, with significant cardiac enlargement predominantly affecting the left side.

Conclusion: Cardiac enlargement causing esophageal stenosis through external compression, leading to MCE retention, is clinically rare. However, foreign body retention in the esophagus poses substantial risks to patients. Utilizing imaging examinations or patency capsules before the procedure can effectively reduce the risk of MCE retention.

Keywords: Magnetically Controlled Capsule Endoscopy; Esophageal Retention; Cardiac Enlargement

Introduction

Cardiac enlargement refers to the dilation of the atria and/or ventricles, resulting in altered cardiac morphology. It is a common clinical manifestation observed in various conditions including heart failure, ischemic heart disease, myocarditis, cardiomyopathy, hypertensive heart disease, and malnutrition. Conventionally, gastroscopy is considered extremely risky for patients with poor cardiac function and should only be performed when the diagnostic benefits outweigh the risks. The advent of magnetically controlled capsule endoscopy (MCE) has resolved this clinical challenge. However, MCE retention remains one of the primary risks associated with this procedure. We present a case of MCE retention caused by external esophageal compression due to cardiac enlargement.

Case Report

A 16-year-old female patient was admitted to our hospital in August 2022 with a one-month history of paroxysmal chest tightness and breathlessness. During her treatment for cardiovascular disease at our institution, she reported intermittent epigastric colicky pain without apparent precipitating factors. The episodes lasted several minutes, occurred predominantly at night, and could be relieved by sitting up, occasionally accompanied by nausea. She denied radiation of pain, abdominal distension, acid reflux, dysphagia, or fever. Since onset, her mental status and sleep were fair, but her appetite was poor with a 5 kg weight loss over the past month. Bowel and bladder functions were normal.

Her medical history included heart failure of undetermined etiology, probable dilated cardiomyopathy, mild aortic regurgitation, moderate mitral regurgitation, mild tricuspid regurgitation, and NYHA Class IV functional status. Laboratory tests revealed leukocytosis of 18.28$\times 10^{9}/L with neutrophil predominance (absolute neutrophil count 13.35$\times 10^{9}/L$), eryth
Abdominal ultrasound showed focal gallbladder wall thickening and roughness with minimal pericholecystic fluid and pelvic effusion, while the liver, pancreas, and spleen appeared normal. The initial impression was probable cholecystitis, for which fasting, fluid resuscitation, anti-infective therapy, acid suppression, and gastric mucosal protection were administered, but symptoms did not improve significantly. To further evaluate the stomach and small intestine, and considering the patient's poor cardiac function and high risk for conventional gastroscopy, MCE examination was performed.

The MCE procedure was initially uneventful; however, the capsule subsequently became retained in the esophagus. During the early stage of retention, we attempted to facilitate passage into the gastric cavity by having the patient drink water and ambulate, but after four hours of effort, the capsule remained lodged in the esophagus. Careful analysis of the real-time MCE images suggested that esophageal stenosis was the likely cause of retention.

To resolve the retention, emergency gastroscopy was performed with the assistance of cardiologists and anesthesiologists, with resuscitation medications prepared and continuous cardiac monitoring maintained. Endoscopy revealed the MCE capsule in the upper esophagus. The esophageal mucosa was smooth, but the lumen was narrowed at 25–30 cm from the incisors, though the endoscope could pass with slight pressure. Advancing past the capsule edge into the gastric cavity, we observed natural cardia opening and closure with a clear Z-line, and patchy congestion of the gastric fundus and body mucosa. Using a snare, we grasped the capsule and delivered it into the gastric cavity [Figure 1: see original paper]. The procedure was smooth, with only mild nausea experienced by the patient. Brief examination revealed smooth mucosa in the gastric cavity, angular incisure, and antrum, with a round, well-opened pylorus and no apparent abnormalities in the duodenum. Follow-up confirmed that the patient passed the capsule successfully after the procedure.

To identify the cause of esophageal stenosis, we reviewed the patient's existing medical records. Two-dimensional echocardiography showed a left ventricular ejection fraction of 24%, left heart enlargement (left atrial anteroposterior diameter 44 mm, left ventricular end-diastolic diameter 68 mm, end-systolic diameter 61 mm), and right atrial and ventricular fullness (right ventricular anteroposterior diameter 27 mm), with thinning of the interventricular septum and left ventricular wall, diffuse hypokinesis, significantly reduced systolic thickening fraction, and reduced right ventricular free wall motion. Cardiac magnetic resonance imaging confirmed left atrial and ventricular enlargement, predominantly left ventricular (left atrial anteroposterior × transverse diameter 42 mm × 70 mm, left ventricular transverse diameter 70 mm). Chest computed tomography [Figure 2: see original paper] revealed narrowing of the middle and upper esoph-

agus with significant cardiac enlargement, predominantly left-sided. Based on these findings, we concluded that the esophageal stenosis was caused by external compression from left heart enlargement.

Discussion

Magnetically controlled capsule endoscopy demonstrates high diagnostic concordance with conventional gastroscopy for gastric lesions, with reported agreement rates of 87–98% [1, 2]. Compared with traditional gastroscopy, MCE offers numerous advantages including safety, comfort, no requirement for anesthesia, and no risk of cross-infection. MCE has proven particularly beneficial for patients with severe underlying conditions who cannot tolerate conventional gastroscopy and has become an important technology for gastrointestinal disease screening in clinical practice worldwide.

MCE retention represents a major complication of the procedure [3]. Retention is defined as capsule persistence in the digestive tract for more than two weeks or when removal requires medication, endoscopy, or surgery. Statistics show that most retentions occur in the small intestine, with an incidence of 1.4–3% [4–6], commonly caused by NSAID-induced inflammatory fibrotic strictures, small bowel tumors [7], and Crohn's disease [4, 8]. However, retention in the upper gastrointestinal tract is not uncommon. Esophageal retention may result from structural lesions including esophageal diverticula, eosinophilic esophagitis, and esophageal ulcers [9], while pyloric stenosis or obstruction [10] and duodenal diverticula [11] can also cause retention. Although the incidence of MCE retention is low, most patients remain asymptomatic when it occurs. The timing of clinical symptom onset varies, but the risk of gastrointestinal obstruction or perforation increases significantly with prolonged retention [12, 13]. For retained capsules, medical or endoscopic removal may be attempted in stable patients with mild symptoms [14, 15], while early surgical intervention is considered for significant bleeding or obstruction. In our patient, MCE retention in the middle and upper esophagus was definitively diagnosed. External esophageal compression due to cardiac enlargement causing stenosis and subsequent MCE retention is rarely reported. Unlike small bowel retention, esophageal foreign body retention often causes significant discomfort, including esophageal compression sensation, chest pain, and dyspnea, creating substantial psychological burden and necessitating prompt, effective management.

Conclusion

This case highlights the importance of strictly adhering to indications and contraindications for MCE to avoid potential impaction or retention. Based on this experience, we recommend utilizing imaging examinations or patency capsules to assess gastrointestinal patency before MCE procedures [16] to minimize retention risk. Should MCE impaction or retention occur, immediate and appropriate measures should be taken to retrieve the capsule promptly and minimize

patient harm.

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Note: Figure translations are in progress. See original paper for figures.