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# Spontaneous Intramural Full-Length Dissection of Esophagus Treated with Surgical Intervention: Multidetector CT Diagnosis with Multiplanar Reformations and Virtual Endoscopic Display

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Intramural esophageal dissection (IED) is an uncommon disorder characterized by separation of the mucosal and submucosal layers of the esophagus. Iatrogenic intervention is the most common cause of IED, but spontaneous dissection is rare. We report an unusually complicated case of spontaneous IED that involved the full-length of the esophagus that necessitated surgical intervention due to infection of the false lumen. In this case, chest computed tomography successfully established the diagnosis and aided in pre-operative evaluation with the use of various image post-processing techniques.

**Index terms:** *Esophagus; Intramural dissection; Abscess; Computed tomography; Post-processing techniques*

## INTRODUCTION

Spontaneous intramural esophageal dissection (IED) is a rare disorder characterized by sudden onset of severe retrosternal chest pain, odynophagia and dysphagia caused by transverse and longitudinal separation of the mucosal and submucosal layers of the esophageal wall, with or without perforation (1, 2). The etiology of spontaneous IED remains uncertain and conservative management is typically thought to be adequate in uncomplicated cases. Contrast swallow study is typically used to establish a diagnosis of IED. We herein describe a patient in whom chest computed tomography (CT) successfully established a diagnosis of IED and guided the surgical planning. In the present case, CT images with multiplanar reformation (MPR) and three-dimensional (3D) image reconstructions (including a virtual endoscopic view) clearly identified full-length dissection of the esophagus, tears on the dissection flap, and the proximal and distal extents of the false lumen. To the best of our knowledge, MPR and virtual CT endoscopic display of this rare and unexpected etiology of chest pain and dysphagia have not been described in the literature.

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## CASE REPORT

A 54-year-old man was admitted to our hospital with a several-day history of chest pain and swallowing difficulty. The chest pain had commenced after he drank alcohol. Endoscopy performed at another hospital just prior to admission revealed a laceration in the thoracic esophageal mucosa (Fig. 1A). The patient had been diagnosed with diabetes mellitus 10 years previously.

Upon admission, chest CT was performed under the impression of esophageal perforation to assess the underlying esophageal causes and mediastinal

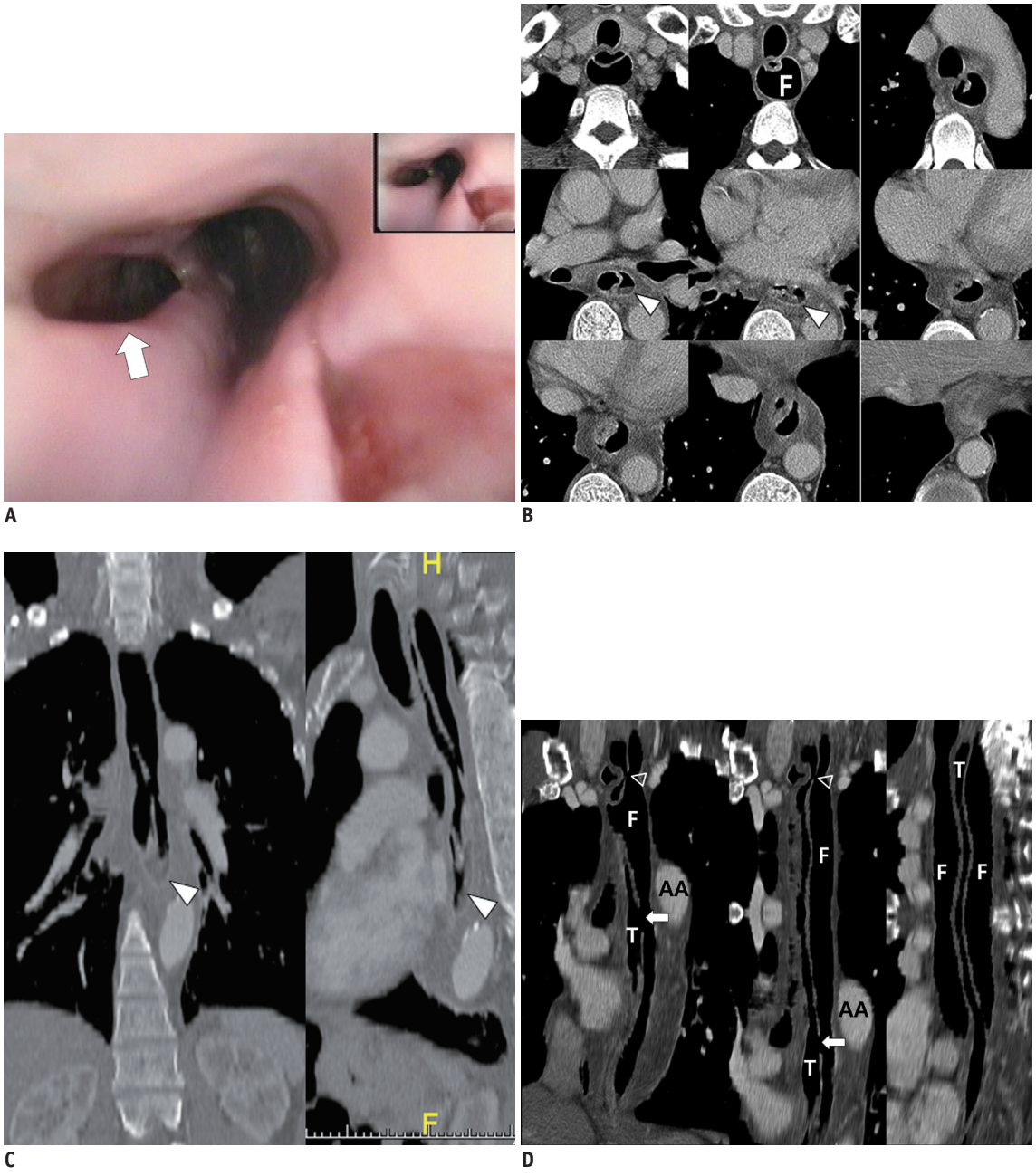


**Fig. 1. 54-year-old man with spontaneous intramural dissection of esophagus.**
**A.** Endoscopy performed at another hospital just prior to admission to our hospital demonstrated laceration (white arrow) in mid-thoracic esophageal mucosa. **B, C.** Axial **(B)** and coronal and sagittal images **(C)** from enhanced CT showed esophageal double lumen, intervening mucosal flap, and absence of mediastinal free air. Air-fluid level and mottled soft tissue densities (white arrowhead) are seen in false lumen (F), consistent with infected fluid and food materials. **D.** Curved MPR images show two mucosal tears on dissection flap at cervical and mid-thoracic esophagus, and full extent of false lumen in single image plane. Note tears at cervical (open arrowheads) and mid-thoracic (white arrows) esophagus. AA = aortic arch, F = false lumen, T = true lumen

complications. Axial, coronal, and sagittal images revealed the esophageal double lumen and the absence of free air in the mediastinum (Fig. 1B, C). Curved multiplanar reconstruction images showed the full extent of false lumen with two tears on mucosal flap at cervical and mid-thoracic esophagus in a single image plane (Fig. 1D). 3D volume rendering images demonstrated tears on the mucosal flap between the distended false and collapsed true lumen (Fig. 1E). Virtual CT endoscopic (Fig. 1F) views from the same CT dataset also depicted an elliptically shaped laceration on the dissection flap and an air-distended false lumen extending from the cervical to the distal esophagus,

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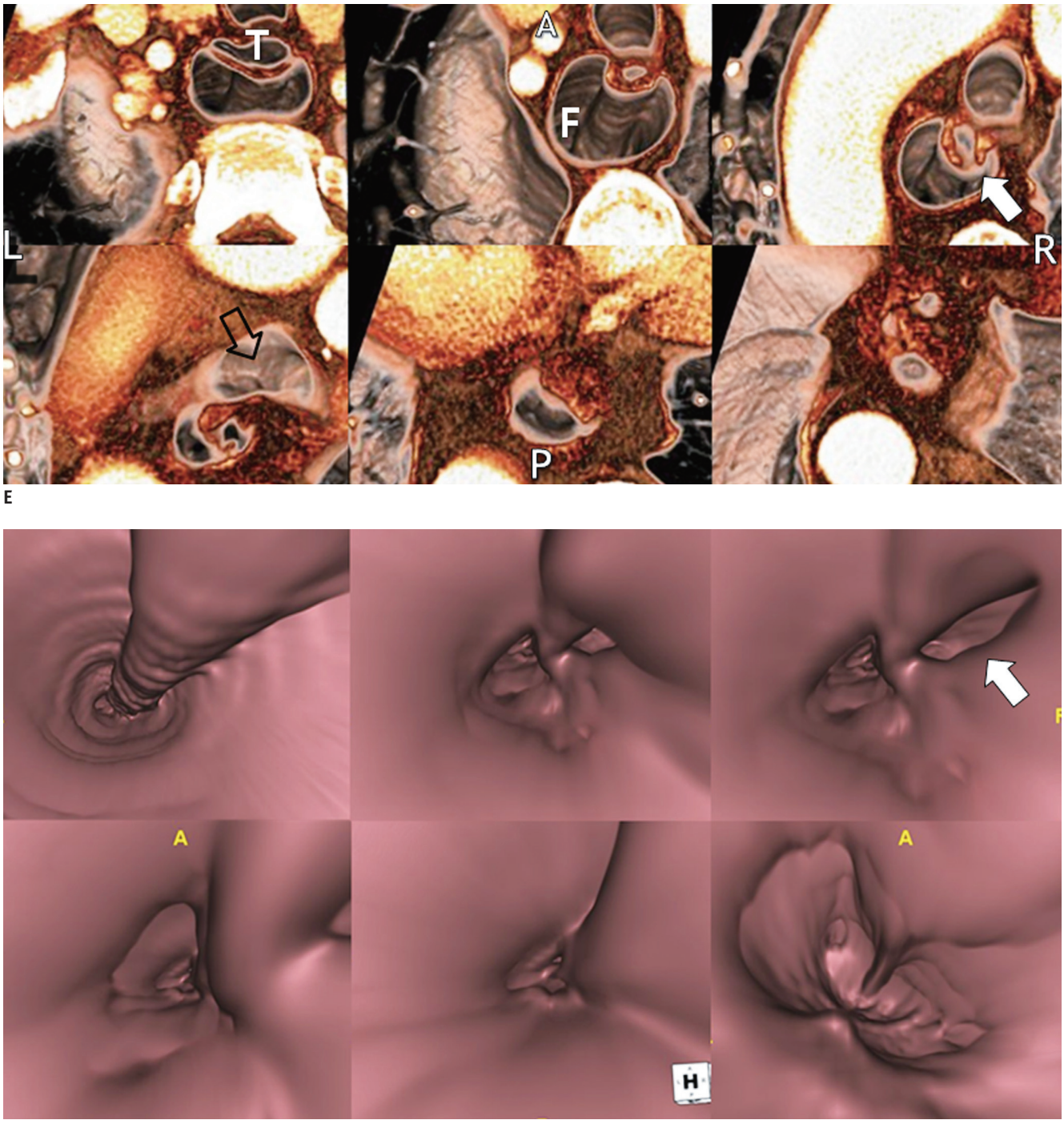
comparable to what was seen on the fiberoptic endoscopic view.

Even though he experienced dysphagia and chest pain, the patient had not ceased to eat and drink prior to admission, and consequently developed signs of infection (high fever and an elevated blood white blood cell count) that were apparent on admission. Since the clinical and imaging findings supported a diagnosis of a complicated

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**E.** Three-dimensional volume rendering images demonstrated mucosal tear (white arrow) in dissection flap between false and true lumens. Note level of tracheal bifurcation (open arrow). Images run from proximal (left, upper) to distal (right, lower) esophagus. **F.** Virtual CT endoscopic views reconstructed from original CT dataset also depicted endoluminal images of air-distended false lumen, as well as mucosal lacerations on dissection flap (white arrow). False lumen extended from cervical to distal esophagus. Images run from proximal (left, upper) to distal (right, lower) esophagus. F = false lumen, T = true lumen, L = left, R = right, A = anterior, P = posterior

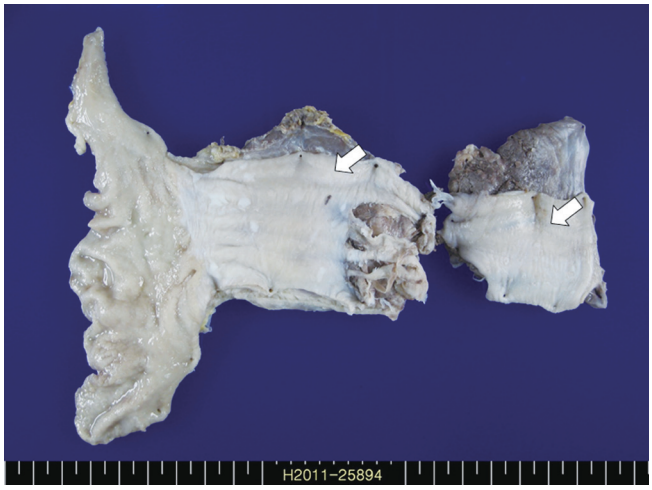


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**Fig. 1. 54-year-old man with spontaneous intramural dissection of esophagus.**
**G.** Gross surgical specimen of resected esophagus and part of gastric fundus (left end). Resected esophagus was opened longitudinally and stretched. Note thin and whitish esophageal mucosa (white arrows) separated from dark submucosal and muscle layers.

IED with infection, dissected segment was surgically excised (Fig. 1G) and an esophagogastric anastomosis was constructed. Abundant pus and food material were found in the distal blind end of the false lumen of the surgical specimen. The presence of cervical and mid-thoracic mucosal tears was also confirmed upon specimen examination.

## DISCUSSION

Intramural esophageal dissection is a rare disorder involving separation of the mucosal and submucosal layers of the esophageal wall. It was first described by Marks and Keet (3) in 1968, but the pathophysiology of spontaneous IED remains unknown (2, 4). The causes of IED include iatrogenic instrumentation, mucosal injuries from ingestion of sharp foreign body, or spontaneous (5). However, most cases of IED are attributable to iatrogenic causes, such as standard endoscopy and endoscopic intervention (6). Spontaneous IED occurs commonly in elderly women (1), in those who have bleeding tendency due to underlying liver cirrhosis (4), and in patients on anticoagulant agent or who have an inherent coagulopathy (6). Patients usually present with acute chest pain, odynophagia, dysphagia, and (rarely) hematemesis. Thus, their symptoms may occasionally mimic those of acute myocardial infarction or aortic dissection (1).

Traditionally, a fluoroscopic upper gastrointestinal series or upper gastrointestinal endoscopy has been widely used to diagnose IED (7). Recently, CT and magnetic resonance imaging have proven useful for differential diagnosis of IED compared with other causes of chest pain (2, 6). CT can be used to evaluate the full extent of the lesion through MPR images, and helps to differentiate IED from acute cardiovascular and other esophageal diseases (6). CT of IED shows an eccentric true lumen surrounded by a thickened wall that is separated from a false lumen by a thin mucosal flap (1, 8). In most cases of IED, the false esophageal lumen is located posterior to the true lumen (6). The false lumen is a well-defined tubular, blind-ending structure, lying parallel to the esophageal true lumen and usually larger than the true lumen. With the recent advances in multidetector CT (MDCT) technology and the software tools that facilitate viewing and analysis of large-volume datasets, MPR images, maximal or minimal intensity projection views, and 3D-rendered images including virtual endoscopic images have become widely available and easily performed in various organs, and diagnostic capabilities of MDCT have been enhanced (9). In this case, curved MPR images clearly depicted an additional smaller tear on the cervical esophagus that had not been described on endoscopy conducted prior to admission to our hospital, and revealed the full extent of the dissection and two tears on the mucosal flap in a single image plane. Further, 3D volume-rendered images including a virtual CT endoscopic view were also reconstructed using the same CT dataset. They were comparable to standard endoscopic images and revealed the extent of and bifurcation in the false and true lumens, presence of a mucosal flap between them, intramural air, appearance of the mucosal surface, and distal extent of the false lumen. This enabled a comprehensive pre-operative analysis of IED.

Although CT diagnosis of IED using virtual 3D imaging has not been described previously, CT esophagography has proven to have many advantages in the diagnosis of various esophageal diseases. Kim et al. performed 3D CT esophagography using effervescent agents in the patients with esophageal tumors. These images yielded information on endoluminal morphology and the longitudinal extent of the esophageal tumor, degree of luminal stenosis, and invasion to adjacent mediastinal structures, even though fluoroscopic barium study is still incorporated into the routine preoperative work-up (9). Furthermore, CT esophagography easily detected a small amount of air collection emanating from the esophageal perforations and was superior to fluoroscopic esophagography in this regard

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(10). Thus, they concluded that CT esophagography was easy to perform and fulfilled the roles of both endoscopy and conventional CT (10). Such a one-step procedure would be both convenient and cost-effective for patients. In this case, although we did not use effervescent agents, only a few mouse clicks were needed to yield curved MPR images showing double lumen and endoscopic views, mainly because of natural contrast by a large amount of air collection between the mucosal and submucosal layer, as has been frequently described in the literature. Thus, when IED is found on chest CT, we believe that curved MPR, 3D images, and endoscopic views may be reconstructed quickly and easily from the same CT dataset to enhance our intuitive understanding of the lesion.

Management of the IED is conservative including nothing by mouth, fluid resuscitation, nutritional support, or administration of broad-spectrum antibiotics (2, 5). Endoscopic interventions including incision of the mucosal septum, balloon dilatation, and metal stent insertion (4) have been considered as alternative therapies. Surgery may be performed on patients who are refractory to conservative management, or on those with complications that include esophageal perforation, hemorrhage, or abscess formation (2), as in this case.

In summary, we report an unusually complicated case of spontaneous IED that involved full-length of the esophagus and required surgical intervention to remove infected tissues. In this case, chest CT enabled the diagnosis and pre-operative evaluation of this rare and unexpected etiology of chest pain and dysphagia effectively with the use of advanced image reconstruction techniques, such as MPR and 3D volume rendering images, and virtual endoscopic views.

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