

# Esophageal Perforation, the Most Feared Complication of TEE: Early Recognition by Multimodality Imaging

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Esophageal perforation is the most feared complication of transesophageal echocardiography (TEE), although the overall risk is extremely low. We report a case of esophageal perforation in a 77-year-old woman who had no apparent contraindications to TEE. Chronic steroid therapy for symptoms of asthma as well as osteophytic changes of the cervical vertebrae contributed to her increased risk of perforation. Unlike in prior reports, the perforation in this case was fortuitously recognized rapidly due to ingestion of a carbonated beverage for evaluation of a hiatal hernia suspected during a subsequent transthoracic echocardiogram performed because of inadequate TEE images after a difficult intubation. The incidence of esophageal perforation in our series (1 in 5,000 TEEs, 0.02%) is similar to that reported in the literature. Early recognition and prompt surgical repair of the esophageal perforation led to favorable outcome in our patient. (Echocardiography 2011;28:E56-E59)

**Key words:** transesophageal echocardiography, complication, esophagus, perforation

## Case Report:

A 77-year-old woman with a history of hypertension, osteoporosis, long-standing asthma and a prior transient ischemic attack, presented for an outpatient transesophageal echocardiogram (TEE) to rule out left atrial myxoma which had been suspected on transthoracic echocardiogram (TTE) performed at the referring institution. The TTE report but not the actual video recordings were available at time of TEE. In the process of obtaining informed consent for the procedure, her medical history and the list of outpatient medications were reviewed. No contraindications for TEE were found. It was noted however, during physical exam that her skin was thin and fragile with ecchymosis and subcutaneous atrophy.

Following intravenous sedation with 6 mg of midazolam and 100 mcg of fentanyl, the TEE was initiated after several attempts by two different operators to pass the probe. Despite relatively high doses of medications, the patient was not deeply sedated and could still respond to commands. Once the probe was inserted, only the

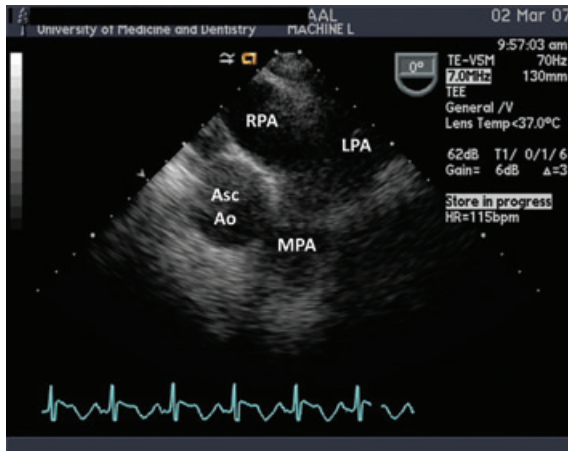
cranial portions of the large vessels could be visualized (the area around the main pulmonary artery and its bifurcation as well as the aortic arch and descending thoracic aorta; Fig. 1 and movie clip 1). After a resistance to further probe insertion was felt, the probe was withdrawn and TEE was aborted. The patient's vital signs at this point were the same as before beginning the procedure (BP 130/70 mm Hg; HR 100 beats per minute; arterial oxygen saturation 99% on room air) and the patient had no complaints.

Since the left atrium could not be visualized on the aborted TEE, additional TTE images were then obtained. TTE revealed a mass (approximately 4.8 cm × 2.4 cm) around the cranial portion of the left atrium, lateral to the ostium of the right upper pulmonary vein Figure 2 and movie clip 2. In order to differentiate between a blood-containing structure (such as a cardiac tumor or tortuous descending aorta), and a nonvascular structure (such as a hiatal hernia), the patient was given a perflutren lipid microsphere (Definity, Lantheus Medical Imaging, N. Billerica, MA, USA) injection. The mass did not opacify. This finding argued against a blood-pool structure and in favor of a nonvascular mass or an extrinsic structure such as a hiatal hernia

To confirm this, the patient was then asked to drink a glass of a carbonated beverage with

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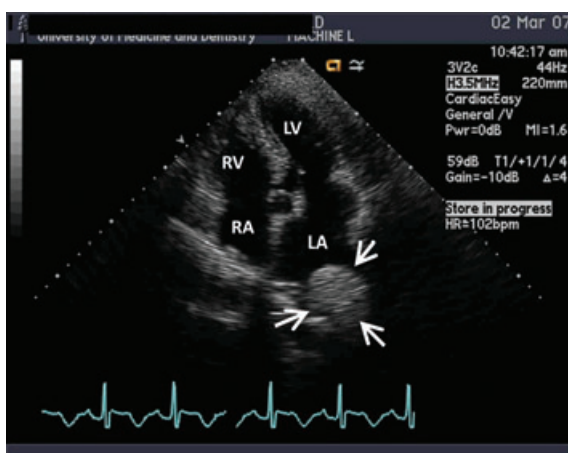
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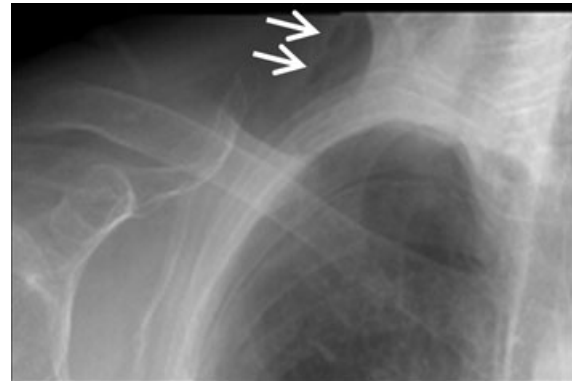
**Figure 1.** Echocardiogram obtained using standard TEE probe located likely in the right superior mediastinum after esophageal perforation. Only portions of the ascending aorta (Asc Ao), and the pulmonary artery could be seen (MPA = main pulmonary artery; RPA = right pulmonary artery; LPA = left pulmonary artery). The findings are further visualized in movie clip 1.

the expectation that bubbles would be visualized inside the mass if it was a hiatal hernia. However, shortly after drinking a very small amount of the beverage, the patient complained of extremely intense right-sided pleuritic chest pain. She became tachycardic and diaphoretic.

Urgent chest radiograph revealed a small area of lucency in the neck suggestive of subcutaneous air (Fig. 3). This was followed by an immediate noncontrast computed tomography (CT) of the chest which revealed subcutaneous emphysema of the soft tissues of the neck and anterior



**Figure 2.** A large circular mass-like structure, suspected to be a hiatal hernia (arrows) causing extrinsic compression of the left atrium (LA) is seen on the transthoracic apical four-chamber view. LV = left ventricle; RV = right ventricle; RA = right atrium. The findings are further visualized in movie clip 2.



**Figure 3.** The enlarged portion of the chest radiograph reveals lucency in the right neck (arrows) indicative of subcutaneous emphysema due to ipsilateral esophageal perforation by TEE probe.

chest, as well as extensive pneumomediastinum (Fig. 4; movie clips 3 and 4). The amount of visualized air progressively increased during CT imaging which also revealed a large hiatal hernia and degenerative changes throughout the visualized cervical and thoracic spine. Immediately afterwards, fluoroscopy with ingestion of an iodinated radiopaque agent (Gastrografin, Schering AB, Berlin, Germany) revealed extraluminal drainage of the contrast into the right pleural space (Fig. 5). These findings were consistent with esophageal perforation as a result of insertion of the TEE probe.

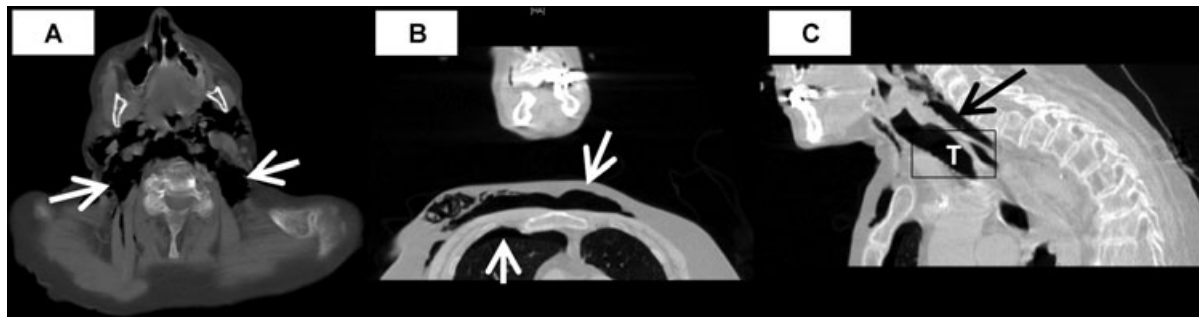
The patient was immediately transported to the operating room where a 2.5-cm perforation of the esophagus at its origin, at the level of the cricopharyngeus muscle, was found and then repaired with a single-layer closure.

It was only at this time that we became aware that the patient had been receiving parenteral triamcinolone (Kenalog, Bristol-Myers Squibb, Princeton, NJ, USA), a synthetic corticosteroid, for the past 25 years to control the symptoms of asthma.

Postoperatively, a repeat Gastrografin swallow test 6 days later showed no evidence of residual leakage from the esophagus. The patient was doing well on a follow-up visit 6 weeks later.

### Discussion:

TEE is a widely used diagnostic tool in clinical cardiology. In general, it is considered to be a safe procedure. However, it carries certain inherent risks that may occur even if TEE is flawlessly performed. Complications of TEE examination that have been reported range from lip injuries and hoarseness of minor clinical consequence, to life-threatening emergencies that require immediate medical or surgical attention. According to the Task Force on Perioperative



**Figure 4.** Extensive air accumulation is seen in the neck (Panel A), anterior chest wall and right pleural space (Panel B), as well as in the prevertebral space (Panel C) seen on noncontrast computed tomography of the chest following esophageal perforation by TEE probe. Arrows point to air-filled spaces rendered in black on CT image. T = trachea. These pathologic findings are further visualized in movie clip 3 (coronaxial cuts) and movie clip 4 (sagittal cuts).

Transesophageal Echocardiography, “in most studies, serious complications including esophageal injury, vocal cord paralysis, dysrhythmias, hypotension, seizures, and cardiac arrest, occur in less than 3% of TEE examinations.”<sup>1</sup>

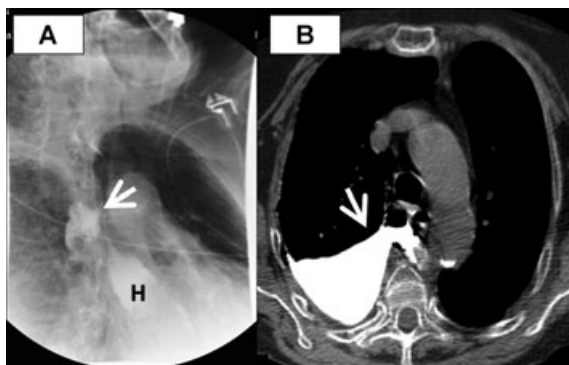
Specific risk of experiencing adverse effects during TEE depends upon patient age, health history, and anatomical variations. The most feared complication of the procedure is esophageal perforation. Esophageal damage by the TEE probe is believed to occur both by friction against the surrounding tissue and by thermal energy released by the probe that may cause localized esophageal injury.<sup>2</sup> Conditions which make the esophageal tissue more susceptible to mucosal trauma during probe insertion and manipulation increase the risk of perforation. Therefore, TEE examination is relatively contraindicated in patients with specific esophageal diseases including esophageal or gastric varices, Barrett’s esophagus, Zenker’s diverticulum, esophageal or pharyngeal carcinoma, stric-

tures, and Mallory–Weiss tears, as well as in patients who have recently received radiation therapy of the esophageal area and who have serious risk of bleeding.<sup>3</sup>

The patient we have described had no reported history of esophageal pathology, prior radiation, or disorders of hemostasis. Nonetheless, esophageal perforation unfortunately occurred. There were factors that predisposed our patient to perforation, none of which would have been a contraindication for TEE if considered alone. The patient’s long-term steroid therapy, which was not originally revealed, may have led to additional weakening of the surrounding connective tissues and made the esophagus more susceptible to perforation. Chronic steroid use probably contributed to her osteoporosis and atrophic skin as well. Furthermore, the osteophytic changes of the cervical vertebrae found on CT further increased risk of perforation, as the spurs can impinge upon the posterior wall of the esophagus and make TEE probe insertion more difficult.

Upon reviewing the literature, we have found three other case series describing esophageal perforation due to TEE.<sup>3–5</sup> In these studies, as well as in many other isolated case reports in the literature, perforation occurred in patients who had no risk factors or contraindications to TEE and shared no similarities in medical history. Of more than 5,000 TEE examinations performed at our institution in the past 10 years, this is the only case of esophageal perforation (calculated incidence 0.02%), similar to the rates of esophageal perforation reported in the literature (0.01–0.09%; see Table I). As in our case, elderly women have been reported to be at a particularly high risk of esophageal perforation associated with TEE.<sup>5</sup>

The most common site of perforation was the cervical esophagus. The crossing of fibers from the constrictor muscle of the pharynx and the cricopharyngeus muscle is believed to make this portion of the esophagus particularly susceptible



**Figure 5.** Panel A: Spot film from fluoroscopic study of the esophagus after oral administration of iodinated contrast shows extravasated contrast at the level of the aortic arch (arrow) indicating esophageal perforation. H = hiatal hernia. Panel B: Image from CT scan of the chest demonstrates accumulation of the extravasated contrast (arrow) in the right mediastinum and right pleural space.

**TABLE I**

Incidence and Time to Detection of Esophageal Perforation Following TEE

Source	No. of TEEs Performed	No. of Cases of Esophageal Perforation (Incidence, %)	Time from TEE to Detection of Perforation
This case	5,000	1 (0.02%)	1 hour
<i>Anesth Analg</i> 2001; 92:1126–1130	7,200	1 (0.01%)	48 hours
<i>J Am Soc Echocardiogr</i> 2005; 18:925–929	10,000	3 (0.03%)	4–22 hours
<i>J Cardiothorac Vasc Anesth</i> 2009 Feb;23(1):62–65	10,000	9 (0.09%)	0–6 days

to injury and perforation.<sup>6</sup> It is hypothesized that injury to this area implies that the trauma occurred during probe insertion, and is unrelated to manipulation during the examination.

There is great variation in the time to presentation of esophageal injury after TEE, as shown in Table I. To the best of our knowledge, the perforation was discovered in our patient earlier than in any case described in the literature. This was partly due to a fortuitous ingestion of a carbonated drink whose extravasation into the mediastinum made the patient very symptomatic. As the time to surgical repair is the main determinant of prognosis in esophageal perforation, early recognition and repair is paramount.

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## Supporting Information

Additional Supporting Information may be found in the online version of this article:

- Movie clip 1** for Figure 1.
- Movie clip 2** for Figure 2.
- Movie clip 3** for Figure 4.
- Movie clip 4** for Figure 4.

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