Clinical Features of Complications From Transesophageal Echocardiography: A Single-Center Case Series of 10,000 Consecutive Examinations

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Background: **Transesophageal echocardiography (TEE) is an essential diagnostic tool that has gained widespread use in clinical cardiology. It is considered reasonably noninvasive and safe; however, insertion and operation of the TEE probe may cause hypopharyngeal, esophageal, or gastric trauma. The current study reports a single-center experience of esophagogastric trauma in 10,000 consecutive TEE examinations.**

Methods: **TEE examinations were performed by 9 attending physicians who were trained in endoscopic procedures and had been performing TEE studies for at least 1 year.**

Results: **One case of hypopharyngeal perforation (0.01%), 2 cases of cervical esophageal perforation (0.02%), and no cases of gastric perforation (0%) occurred after TEE examination. No fatalities (0%) occurred. We describe the clinical characteristics of individuals who experienced esophageal perforation during this 10-year period.**

Conclusions: **This single-center study demonstrates that TEE examinations are associated with a very low risk of esophagogastric trauma when performed in a safe setting by experienced operators.**

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Over the last decade, TEE has achieved widespread application in clinical cardiology. The increasing use of TEE stems from its real-time ability to evaluate myocardial function, cardiac valve performance, great vessel pathology, cardioembolic sources, intracardiac shunts, and overall hemodynamic state.[1]

TEE is considered noninvasive and safe; however, insertion and manipulation of the TEE probe may infrequently cause oropharyngeal, esophageal, or gastric trauma.[2] To date, few reports have considered the risk of hypopharyngeal, esophageal, and gastric perforation during consecutive TEE examinations in adult nonsurgical patients. Here we report the incidence and clinical features of TEE-associated esophagogastric trauma in a single-center series of 10,000 adult nonsurgical cardiology patients. We describe the clinical presentations and secondary complications associated with these perforations.

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METHODS

The study population comprised 10,000 consecutive nonsurgical patients who underwent TEE between 1993 and 2004. In a random sampling of 100 patients, the average age was 54.7 years and 55 were male. The average body surface area was 1.92 m^2. Some 87% of the TEE examinations were performed in our echocardiography laboratory, with the remaining 13% performed in the emergency department or intensive care unit. Patients fasted for at least 4 hours before the examination. Examinations were performed under conscious sedation using a combination of a benzodiazepine (midazolam hydrochloride) or narcotic (fentanyl or morphine), which was prescribed at the discretion of the attending cardiologist. When possible, local oropharyngeal anesthesia was administered using viscous lidocaine. Patients were monitored with continuous telemetry and pulse oximetry. Blood pressure was measured every 5 minutes or more frequently when indicated. Before TEE probe insertion, a dental guard was inserted. Patients were placed in the left lateral decubitus position for the examination. A lubricated multiplane TEE probe (Philips, Andover, Mass) was then blindly inserted into the esophagus.

The average time of the TEE examination was typically less than 20 minutes. The potential risk-to-benefit ratio of the TEE exam was assessed for each patient. Relative contraindications included significant coagulopathy (INR > 2.5), esophageal or pharyngeal carcinoma, and esoph-

ageal or gastric varices. The TEE studies were performed only physicians who had training in routine endoscopy and were level-III certified (or eligible) in TEE by the American Society of Echocardiography. Following our laboratory's protocol, the noninvasive cardiology fellow-in-training attempted the first 2 passages of the TEE probe. If these were unsuccessful, then the attending physician made any remaining attempts.

RESULTS AND CASE REPORTS

Esophageal trauma occurred in 3 of the 10,000 consecutive TEE examinations (0.03%). No fatalities occurred.

Patient 1

A 73-year-old Hispanic man (body mass index [BMI] 29.8) with a history of coronary artery disease and peripheral arterial disease presented with atrial fibrillation. After therapeutic anticoagulation with heparin, the patient was referred for TEE to rule out a intracardiac thrombus before electrical cardioversion was attempted.

After induction of conscious sedation with 4 mg midazolam hydrochloride and 100 μg fentanyl, the TEE probe was advanced into the esophagus. Intubation proved difficult and was attempted numerous times by 2 different operators before it was successful. Blood-tinged secretions were noted transiently but cleared promptly. Once the patient was intubated, the procedure proceeded smoothly.

Approximately 12 hours after the TEE examination, the patient experienced hemoptysis and mild shortness of breath. He was hemodynamically stable and had no oxygen requirement. Physical examination revealed crepitus on the anterior chest wall. Laboratory analysis at the time of the hemoptysis demonstrated an increase in white cell count from 6.3 K/μL to 17.7 K/μL. The hematocrit remained stable. No other significant changes in laboratory values were noted. Room air arterial blood gas analysis values were within normal limits.

A chest roentgenogram obtained at that time demonstrated soft tissue emphysema as well as a small pneumomediastinum (Figure 1, *A*). Chest computed tomography (CT) scan revealed a moderate amount of air throughout the tissues of the thorax (Figure 1, *B*). In the soft tissues above the sternal notch, a collection of subcutaneous air extended superiorly. Bilateral air collections were located along the posterior thoracic wall and medial to the scapulae. In the mediastinum, air surrounded the trachea and esophagus and extended inferiorly to the border of the aortic root. A fluid collection was located inferior to the trachea and lateral to the esophagus at the level of the aortic arch.

The otolaryngology service was consulted, and urgent surgical exploration was recommended. An

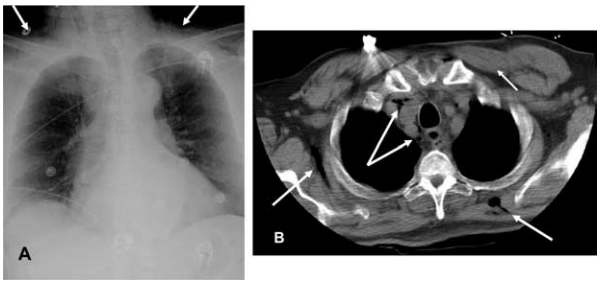

Figure 1 (**A**) Chest roentgenogram demonstrating significant neck subcutaneous emphysema (*arrows*). (**B**) Chest CT revealing air collections in the mediastinum and adjacent to the thoracic wall (*arrows*).

irregular mucosal tear was identified in the left piriform sinus at the junction of the lateral and medial walls. A 4 × 4 cm encapsulated abscess flanked the mucosal tear. After debridement and irrigation of the abscess, the mucosal tear was sutured. A Penrose drain was placed, and the wound was closed without complication.

The patient did clinically well during the postoperative period. A barium esophogram before discharge demonstrated no contrast extravasation at any level of the oropharynx, pharynx, or esophagus. The patient was discharged in stable condition 19 days after his initial TEE examination.

Patient 2

A 79-year-old Caucasian man (BMI 25.2) with a history of peptic ulcer disease was admitted with a transient ischemic attack. A TEE examination was performed to rule out an intracardiac source of embolus. The patient was placed under conscious sedation with 3 mg midazolam hydrochloride and 100 μg fentanyl. The TEE probe was advanced with significant difficulty to the esophagus; multiple attempts were required. After successful intubation, the remainder of the TEE examination proceeded without problem. The patient's vital signs remained stable during the procedure, and care was taken to suction oral secretions to avoid aspiration.

Approximately 4 hours after the procedure, the patient complained of a severe sore throat. He was hemodynamically stable and without significant oxygen requirement. Laboratory analysis revealed an increase in the white cell count from 9.6 K/μL to 12.6 K/μL, with an associated drop in hematocrit from 40.1% to 34.5%. A chest roentgenogram revealed new soft tissue emphysema in the left supraclavicular fossa and on the left side of the neck (Figure 2, *A*).

An esophogram demonstrated significant extravasation of barium contrast medium into the pharynx and hypopharynx through a penetrating injury of the left piriforum sinus that was associated with