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INVITED ARTICLE

Transnasal esophagoscopy: State of the art

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The purpose of this article is to trace the evolution of esophagoscopy from its inception over 100 years ago to its current state of the art. In so doing, the positive consequences that will likely result because of the transition from rigid, per oral, sedated esophagoscopy to flexible, transnasal, unsedated esophagoscopy will be described. Several of the seminal advances in esophagoscopy over the past century were the result of innovations by otolaryngologists. Until 10 years ago, the esophagoscopy performed by otolaryngologists had primarily been a rigid, transoral approach performed with the patient under general anesthesia or under intravenous sedation with local anesthesia. However, beginning in the mid 1990s otolaryngologists began to perform esophagoscopy utilizing an ultra thin, flexible scope passed transnasally, with the patient not sedated, solely relying on topical anesthesia. This approach, called Transnasal esophagoscopy (TNE), will ultimately be found to have the following advantages over traditional, peroral, rigid, or flexible esophagoscopy carried out in a sedated patient: 1) enhanced patient safety; 2) improved survival of esophageal adenocarcinoma; 3) increased practice efficiency. Within a short time TNE will be the primary manner in which the esophagus is examined by clinicians. It will be up to the otolaryngology community at large to apply the same levels of expertise that currently exist with respect to laryngeal disease to esophageal disease.

TRANSORAL ERA

Otolaryngologists have been performing esophagoscopy since the 1890s.[1] Esophagoscopy was performed with a transoral approach initially with the patient neither sedated nor anesthetized.[2,3] From the 1940s until the early 1960s, topical anesthesia and intramuscular sedation was generally used during esophagoscopy.[4] Since the late 1960s transoral rigid esophagoscopy has been routinely performed in the operating room with the patient under general anesthesia.

Schindler, a gastroenterologist, developed the first flexible, nonfiberoptic, gastroscope in 1932.[5,6] Over 20 years later Hirschowitz, also a gastroenterologist, developed the first nonchannel containing flexible fiberoptic gastroscope.[7] In 1963, Hirschowitz then developed the first fiberoptic esophagoscope that contained internal channels. As a result, the clinician had the capability of administering air, water, and suction through the flexible telescope as well as the opportunity to perform tissue biopsies.[8]

TRANSNASAL ERA

In 1994 Shaker, a gastroenterologist, published the first article on unsedated, transnasal esophagogastroduodenoscopy (EGD).[9] However, few gastroenterologists (GI) adopted the "Shaker" technique, primarily due to their unfamiliarity with intranasal anatomy and their overall trepidation of performing EGD without conscious or intravenous sedation. Around that time, unsedated transnasal esophagoscopy (TNE) began to be performed by a single otolaryngologist.[10] This experience was presented for the first time in 1998, at the American Broncho-Esophagological Association (ABEA) annual meeting in Palm Beach, FL, where a live demonstration of an unsedated TNE was performed.

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Subsequently, the first article by an otolaryngologist on TNE was published in 2001.[10] Shortly thereafter, several articles on TNE were published in the otolaryngology literature.[11-13] Otolaryngologists are quite facile with endoscopic intranasal anatomy and are extremely familiar with performing office-based procedures without needing conscious sedation.

From 1996 to the present, there have been numerous publications in the gastrointestinal literature that compared unsedated transnasal and sedated transoral upper endsocopy that have shown no difference between the 2 techniques with respect to patient safety, feasibility, and patient tolerance.[14-17] Furthermore, it has been demonstrated that TNE is as accurate as conventional upper endoscopy to detect Barrett esophagus.[18] In addition, recent work has shown that for patients who have reflux symptoms (heartburn, regurgitation, dysphagia), but who do not have other gastric or duodenal symptoms (abdominal pain, nausea, or history of gastric or duodenal ulcer), an endoscopic examination of the esophagus alone is sufficient to diagnose the cause of their problem.[19] Finally, and this study will likely have the greatest impact on otolaryngologists thinking about performing TNE, very recent work has demonstrated that laryngopharyngeal reflux (LPR) symptoms, specifically cough, better predicts the presence of esophageal adenocarcinoma than traditional gastroesophageal reflux disease (GERD) symptoms such as heartburn and regurgitation.[20]

GASTROESOPHAGEAL REFLUX DISEASE, BARRETT ESOPHAGUS, AND ESOPHAGEAL ADENOCARCINOMA

Peptic esophagitis was first described in 1935.[21] Subsequently, in 1950 Barrett described columnar-lined esophageal epithelium.[22] A few years later, GERD was linked to BE.[23] The concept is that GERD can injure the stratified squamous epithelium that normally lines the distal esophagus. When columnar cells replace the reflux-damaged squamous cells, the resulting condition is called Barrett esophagus (BE).[24,25] Finally, in 1975, GERD was linked to BE and esophageal adenocarcinoma.[26]

Since the 1960s esophageal adenocarcinoma has been the most rapidly increasing solid organ tumor in the Western World. Specifically, incidence rates for adenocarcinoma in the lower third of the esophagus are unmatched by any other tumor.[27,28] The incidence of adenocarcinoma of the esophagus has increased by 350% over the past 30 years in white men (300% in white women).[29,30] The risk factors for esophageal adenocarcinoma are presence of BE and GE reflux. The potential public health problem is enormous as GERD affects 40% of adults in the United States.[31] Further, BE develops in 5% to 20% of patients with GERD and, as has been mentioned, predisposes to esophageal adenocarcinoma.[32]

Most cases of esophageal adenocarcinoma are detected when the cancer is advanced and incurable with the 5-year survival rates of symptomatic esophageal adenocarcinoma $<10\%$.[33,34] Systematic endoscopic biopsy can detect adenocarcinoma of the esophagus at an early stage with the 5-year survival increasing to 80% to 90% as a result of early detection.[35] Therefore, endoscopic surveillance is recommended for early detection of adenocarcinoma in patients with BE.[35]

RISK OF CONSCIOUS SEDATION DURING ESOPHAGOSCOPY

Most complications related to EGD are due to conscious sedation; cardiopulmonary events comprise over 60% of all major complications.[36] Conscious sedation may result in oversedation, hypoxemia, arrhythmia, and vaso-vagal reaction. Intravenous sedation has been shown to be the most common independent risk factor for the development of negative outcomes within 30 days of outpatient upper GI endoscopy.[37,38] Unsedated TNE necessarily obviates the primary source of complications related to upper endoscopy and consequently removes a major stumbling block to frequent, routine endoscopic surveillance of the esophagus. Imagine a clinical environment where endoscopic examination of the esophagus can take place as readily and complication-free as a transnasal flexible laryngoscopy. Patients will likely have their esophageal lesions detected when early, small, and asymptomatic as opposed to late, large, and symptom-laden. It is not a great leap to see that TNE will likely have a profound impact on improving the incidence of early diagnosis of asymptomatic adenocarcinoma of the esophagus and ultimately lead to improved survival of this disease.

TNE TECHNIQUES

The basic technique used to perform TNE is as follows. The nasal cavity must be anesthetized very well as the diameter of the TNE endoscope ranges from 4.3 mm to just over 6.0 mm (a typical transnasal flexible laryngoscope has a diameter of approximately 3.4 mm). The laryngopharynx should only be lightly anesthetized because having the patient be able to swallow on command is critical to performing a successful TNE. If the patient's hypopharynx is too anesthetized, the patient will not be able to swallow when asked to and, in the worst case scenarios, will be constantly aspirating his/her secretions during the examination. Once adequate topical anesthesia is administered, the TNE scope is then passed transnasally into the hypopharynx. The patient is then asked to swallow, and as the larynx elevates during the swallow, the TNE scope is then passed through the cricopharyngeus muscle into the esophagus. With the patient intermittently swallowing, the scope is then passed to

Figure 1 Distal video chip transnasal esophagoscope; a single wheel transnasal flexible endoscope with the camera located at the most distal portion of the endoscope.

the esophagogastric junction and then into the proximal portion of the stomach.

It is critical to record the TNE with either analog or digital recording devices as review of the examination is quite helpful to look at the cricopharyngeal opening into the esophagus to rule out neoplasm, as well as to study the esophagogastric junction anatomy to rule out Barrett esophagus.

Currently, there are 2 basic types of flexible endoscopes in general use to perform a TNE. One system is a distal video chip endoscope in which the camera is built into the tip of the endoscope (Fig 1). The distal chip endoscopes are generally available with internal channels so that suction, biopsy, and air and water insufflation can take place. The other system is an add-on camera system where a camera is placed on the proximal portion of the flexible fiberoptic endoscope (Fig 2). Various single use, disposable endosheaths may be used with the add-on camera TNE scope system so that suction and biopsy capabilities are possible as well (Fig 3). The choice of instruments used during a TNE is up to the clinician. The critical part of the TNE is the interpretation of the images obtained.

Figure 2 Add-on camera transnasal esophagoscope; a transnasal flexible endoscope with the camera attached to the most proximal portion of the endoscope, at the eyepiece.

Figure 3 Add-on camera transnasal esophagoscope with endosheath placed on scope; a single-use disposable endosheath has been placed on an add-on camera transnasal esophagoscope and a single use disposable biopsy forcep has been passed through the working channel of the endosheath.

PRACTICE EFFICIENCY AND FUTURE RESPONSIBILITIES

TNE is performed in the office without the sophisticated patient monitoring and skilled ancillary personnel that are required during and after esophagoscopy performed with conscious sedation in the endoscopy suite or general anesthesia in the operating room. The move to the office setting therefore reduces overall health care costs and directly enhances the efficiency and productivity of the clinician. As otolaryngologists get reacquainted with the flexible endoscopic views of the esophagus, their most important responsibility will be to match their expertise in the diagnosis and management of hypopharyngeal disease with that of esophageal disease.

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