

Normal Esophageal Physiology and Laryngopharyngeal Reflux

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KEYWORDS

- Esophagus • Anatomy • Physiology • Laryngopharyngeal reflux
- Proton pump inhibitor • pH monitoring • Management

KEY POINTS

- Esophagus is a muscular tube with active peristalsis, which helps propel bolus into the stomach.
- Lower and upper esophageal sphincters act to prevent esophageal and laryngeal exposure to gastroduodenal contents.
- Dysfunction of esophageal peristalsis and/or LES and UES often results in symptoms of dysphagia, chest pain, and chronic pulmonary and laryngeal symptoms.
- Common clinical manifestations of LPR include dysphonia/hoarseness, cough, globus pharyngeus, throat clearing, and dysphagia.
- Laryngoscopic findings are often nonspecific for reflux-induced laryngitis and have high interrater variability.
- In the absence of risk factors for malignancy, empiric 2-month trial of PPI is considered a reasonable approach in patients suspected of having LPR.
- PPI therapy should be tapered in all patients with initial empiric therapy.
- Surgery is not recommended in patients whose symptoms do not respond to PPI unless regurgitation is an accompanying symptom.
- In nonresponders to empiric PPI therapy, other causes for chronic laryngeal inflammation should be entertained.

INTRODUCTION

Esophagus is a complex muscular tube connecting the pharynx to the stomach, which acts as a channel for the transport of food and prevents reflux of gastroduodenal contents. It is the only internal organ that traverses three body cavities. A thorough

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Abbreviations: Esophageal Physiology	
EER	Extraesophageal reflux
GERD	Gastroesophageal reflux disease
LES	Lower esophageal sphincter
LPR	Laryngopharyngeal reflux
PPI	Proton pump inhibitor
TLESR	Transient lower esophageal sphincter relaxation
UES	Upper esophageal sphincter

understanding of this anatomy and physiology is essential in understanding esophageal disease states.

ANATOMY

The proximal margin of the tubular esophagus is the upper esophageal sphincter (UES), the functional unit correlating anatomically with the junction of the inferior pharyngeal constrictor and cricopharyngeus.¹ Although UES function is controlled by numerous muscles based on electromyographic signals,^{2,3} most studies indicate that the primary muscular element that generates tone in the sphincter at rest is the cricopharyngeus.²⁻⁵ It is innervated by the pharyngeal plexus and the recurrent laryngeal nerve. The esophagus extends distally 18 to 26 cm within the posterior mediastinum as a hollow muscular tube to the lower esophageal sphincter (LES) (**Fig. 1**). The LES is a 2- to 4-cm long focus of tonically contracted thickened circular smooth muscle that lies within the diaphragmatic hiatus⁶ and is the major antireflux barrier protecting the esophagus from reflux of the gastric contents.⁷ The LES is innervated by parasympathetic (vagal) and sympathetic (splanchnic) nerves.⁸

The esophageal wall is morphologically distinct compared with the rest of the gastrointestinal tract, because it has no serosa. It is comprised of four layers: (1) mucosa, (2) submucosa, (3) muscularis propria, and (4) the adventitia. The proximal 5% to 33% is skeletal muscle, the middle 35% to 40% mixed muscle, and the distal 50% to 60% smooth muscle.⁹ The muscles are arranged into inner circular and outer longitudinal layers. The smooth muscle portions of the esophageal body are innervated by the vagus nerve, which controls peristalsis under physiologic conditions. Neural innervation of the esophagus is from the myenteric or Auerbach plexus, located between the two muscle layers, and Meissner plexus located in the submucosa.⁷ The myenteric plexus is responsible for esophageal peristalsis, whereas the Meissner complex is the site of afferent sensory input (**Fig. 2**). Excitatory stimulation from acetylcholine mediates contraction of the longitudinal and circular muscle layers. Inhibitory neurons predominantly affect the circular muscle layer by nitric oxide. Excitatory stimulation from acetylcholine has its largest effect proximally, whereas inhibitory effect of nitric oxide is seen distally.¹⁰

PHYSIOLOGY

Functionally, the UES, the esophageal body, and the LES act in coordinated manner to allow normal swallowing. Swallowing begins when a food bolus is propelled into the pharynx from the mouth. This oropharyngeal phase of swallowing is voluntary, whereas the esophageal phase that follows is involuntary. In rapid sequence and with precise coordination the larynx is elevated and the epiglottis seals the airway.

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