CONTINUING EDUCATION

Understanding Normal and Abnormal Swallowing: Patient Safety Considerations for the Perianesthetic Nurse

Nikki Lucci, DNAP, CRNA, Cole McConnell, BSN, Chuck Biddle, PhD, CRNA

Dysphagia is the disruption of the normal swallowing process; its epidemiology is a national health care concern. Dysphagia affects as many as nine million Americans. Understanding normal swallowing mechanics and how they may be disrupted is a vital patient safety goal in rendering care during the perianesthetic period. The diversity of patients and perianesthetic conditions that may cause or exacerbate existing dysphagia requires that a heightened index of suspicion be maintained. In this continuing education article for perianesthetic nurses, we review normal swallowing, pathophysiologic perturbations in the swallowing process, and drug-related impairments.

Keywords: *swallowing, dysphagia, aspiration, perianesthetic complications.*

OBJECTIVES—1. DESCRIBE THE normal swallowing process; 2. identify how different pathologies and medications affect the swallowing process; 3. discuss the prevalence of dysphagia; and 4. discuss the importance of anticipation, assessment and observation of patients for symptoms of dysphagia.

Swallowing is a vital, yet underappreciated, physiologic process involving a complex series of sensory and neuromuscular actions that allow us to eat and breathe, although preventing both from occurring simultaneously. Dysphagia is the disruption of the normal swallowing process, whose epidemiology is a national health care concern. Most adults age 60 years and older will experience dysphagia at some point in their lives. Dysphagia affects as many as nine million Americans.[1] Understanding the physiology of normal swallowing and the factors that may disrupt it is a vital patient safety goal in rendering care during the perianesthetic period. In this continuing education article, we review normal swallowing, pathophysiologic perturbations in the swallowing process, and drug-related impairments.

The Normal Physiology of Swallowing in Humans

Swallowing can be broken down into four sequential phases: the oral preparatory phase, oral transport phase, pharyngeal phase, and esophageal phase. The oral preparatory and transport phases are under voluntary control, whereas the pharyngeal and esophageal phases are regulated by the autonomic nervous system.[2] Information obtained by sensory neurons throughout the oropharynx and esophagus influences the muscular activity and timing of each of these phases.

Nikki Lucci, DNAP, CRNA, Virginia Commonwealth University, Richmond, VA; Cole McConnell, BSN, Virginia Commonwealth University, Richmond, VA; and Chuck Biddle, PhD, CRNA, Departments of Nurse Anesthesia and Anesthesiology, Virginia Commonwealth University Medical Center, Richmond, VA.

Conflict of interest: None to report.

Address correspondence to Nikki Lucci, Virginia Commonwealth University, 1200 East Broad Street, Richmond, VA 23219; e-mail address: luccin@vcu.edu.

1089-9472/$36.00

http://dx.doi.org/10.1016/j.jopan.2016.07.005

The oral preparatory phase is characterized by mastication and preparation of the bolus, a mass of food particles broken down mechanically and chemically in the oral cavity (Figure 1).[3] The masseter, temporalis, and medial and lateral pterygoid muscles, along with the submental or suprahyoid muscles (mylohyoid, geniohyoid, anterior digastric, posterior digastric, and stylohyoid), facilitate mastication by stabilizing and articulating the jaw throughout the oral preparatory, oral transport, and pharyngeal phases.[2,4] The tongue then positions solid food between the teeth.[4,5] The orbicularis oris and buccinator muscles seal the cavity anteriorly and laterally by closing the lips and collapsing spaces between cheek and gum line. The palatoglossus muscle subsequently depresses the soft palate toward the base of the tongue, sealing the posterior cavity.[4,5] This posterior seal is of particular importance to airway protection as it prevents the bolus from moving prematurely into the pharynx. In the case of a liquid bolus, the same process occurs without the need for mastication. Here, the intrinsic and genioglossus muscles of the tongue form a trough midline on the dorsal surface of the tongue, stabilizing the liquid bolus against the hard palate.[4,5] In contrast, a solid bolus is transported from the molars to the vallecular space to conclude the oral preparatory phase.[5]

In the oral transport phase, oral and nasopharyngeal seals generate negative pressure within the oral cavity, whereas the intrinsic and extrinsic muscles of the tongue generate a wavelike contraction that pushes the bolus into the pharynx.[2,4] The posterior tongue and uvula elevate, allowing the bolus to pass the anterior faucial pillars.

The pharyngeal transport phase is the shortest, yet most complex, phase of the swallowing process. The initiation of the pharyngeal phase is triggered by the passage of the bolus beyond the anterior faucial pillars, although the timing of initiation can be modified by bolus characteristics and swallowing pattern.[2-7] The pharyngeal phase begins with contraction of the lateral cricoarytenoid, transverse arytenoid, and thyroarytenoid muscles of the larynx, closing the vocal cords and ceasing respiration.[2-5] Several muscle groups raise the pharynx superiorly and retract the tongue. A peristaltic wave is created, pushing the bolus into the upper esophagus. Simultaneously, the larynx and hyoid bone are raised anteriorly and superiorly, positioning the larynx below the tongue base and inverting the epiglottis; this is vital for airway protection. Elevation of the larynx and pharynx opens the upper esophageal sphincter by pulling open the cricopharyngeal muscle, generating negative pressure that draws the bolus into the upper esophagus.[4,5]

The passage of the bolus beyond the upper esophageal sphincter heralds the onset of the esophageal phase. The cricopharyngeal muscle relaxes just long enough to allow passage of the bolus into the esophagus and quickly contracts again, signaling initiation of esophageal peristalsis.[4,5] Peak hypopharyngeal pressure stimulates the opening of the lower esophageal sphincter soon after, allowing the bolus to travel into the stomach. In a healthy adult, the transit of a bolus from upper to lower esophageal sphincter lasts between 8 and 13 seconds.[4]

Swallowing is regulated by a central pattern generator (CPG) in the medulla oblongata. The CPG is a functional unit consisting of several bilateral anatomic structures: the dorsal swallowing groups within the bilateral nucleus tractus solitarii (NTS), adjacent reticular formations, and ventral swallowing groups on either side of the medulla.[2-7] Sensory information from the oropharynx, larynx, and esophagus travels simultaneously along multiple pathways, including the trigeminal, facial, glossopharyngeal, and vagus nerves, as well as the inferior branch of the superior laryngeal nerve (iSLN).[6,7] Tactile, chemical, and thermal stimuli are modulated by neurons of the NTS, the sensory complex of the CPG, which possess both glutaminergic *N*-methyl-D-aspartate and non–*N*-methyl-D-aspartate receptors.[2] Once the activation threshold has been reached, dorsal swallowing group neurons surrounding the NTS generate a pattern of motor impulses, which are distributed to various motor pathways by the ventral swallowing group.[2,6,7] After bifurcating at the NTS, the iSLN ascends superiorly, allowing descending cortical pathways to modify the brain stem's swallowing threshold and facilitating conscious control of swallowing.[5,6] Table 1 identifies the cranial nerves, which form the efferent pathways of the swallowing reflex.[4]

As respiration and alimentation share a common passageway in the oropharynx, the coordination