

Deglutition Problems In Head And Neck Cancer Patients

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Abstract

Deglutition problems in head and neck cancer patients begin with the tumor itself. Many patients exhibit dysphasia or difficulty swallowing as the first symptom of their cancer. This is particularly true in tumors of the pharyngeal wall and pyriform sinus as well as the posterior oral cavity. In addition, before treatment, most oral cancer patients exhibit reduced sensation in the region of the tumor. Often, this reduced sensation also contributes to swallowing disorders. Physiologic swallowing disorders created by the tumor and its treatment may result in inefficient swallowing or in aspiration. This short scientific communication deals primarily with the effects of radiation and surgery on deglutition in head, neck cancer patients and the possible interventions to ease the problem. The article stresses that good communication between the speech - language pathologist / swallowing therapist and the surgeon will assure that the patient's swallowing rehabilitation proceeds optimally along with specific swallowing maneuvers.

THE EFFECTS OF RADIATION THERAPY ON DEGLUTITION

The immediate and long-term effects of radiation therapy to the tissues of the oral cavity and salivary glands have been clearly documented. Immediate effects during therapy include increased local irritation, mucositis, and edema. Long - term effects include xerostomia, tissue devascularization, increased fibrosis in the tongue and muscles of mastication, and increased rate of caries. How these changes in oral tissues and salivation affect swallowing is unclear. Increased fibrosis will reduce range of motion of the tongue and jaw. Dental changes may affect chewing. The impact of xerostomia on swallowing physiology is unknown.

There are some indications that radiation therapy causes long - term effects on swallowing that is, changes in swallowing which begin at six months or more after treatment. In a study by Ekberg and Nylander,⁸ five patients treat with radiotherapy were studied one year or more after completion of radiation therapy. These patients exhibited significant changes in pharyngeal peristalsis, presumably related to decreased flexibility in the pharyngeal constrictors because of increased fibrosis. As a result of the reduced peristalsis, patients exhibit residual food in the pharynx after the swallow and a tendency to inhale this residue into the airway after the swallow. Reduced pharyngeal peristalsis can become severe enough that it is difficult for the patients to move any food other than liquid through the pharynx and

into the esophagus. The critical dose level beyond which these permanent and long - term effects on the pharynx are created has not been defined. The only patient in the Ekberg study who exhibited normal swallow after radiation therapy had received no more than, 3,000 rads.

THE EFFECTS OF SURGICAL TREATMENT TO THE ORAL CAVITY ON SWALLOWING

Treatment for head and neck cancer can damage one or more of the neuromuscular actions comprising the oral preparatory, oral and/or pharyngeal stages of the swallow. Cancer of the oral cavity requiring surgical excision can cause particularly complex swallowing problems.^{26, 34}

Selection of the surgical reconstruction procedure can significantly increase or decrease the functional outcomes. If the tumor is located in the anterior region of the oral cavity, and a composite resection is necessary, the preservation of neural control and reconstruction, which enables greatest residual tongue movement, will result in the best function. The more the tongue is tethered anteriorly to the floor of the mouth, or restricted in its lateral range of motion, the more severe the swallowing disorder will be. The tongue is responsible for control of food during chewing and propulsion of the bolus backward to initiate the swallow. Tongue movement is a part of the stimulus to elicit the pharyngeal swallow, and plays a role in generating pressures in the oral pharyngeal region, thus contributing to the pharyngeal swallow as well as the oral swallow. Any

reconstruction of the anterior floor of mouth that inhibits tongue tip and lateral movement will reduce the patient's ability to chew, to control food in the mouth, and to initiate the swallow. The swallowing therapist will always need to confer with the surgeon regarding the exact extent of the resection and the exact nature of the reconstruction. These two factors will generally provide the information needed to predict or determine the exact nature of the swallowing problems the patient will exhibit.

If the tumor is located in the posterior oral cavity in the area of the tonsil or base of tongue, the surgical treatment will usually cause more severe swallowing problems than if the tumor were located anteriorly. The region of the posterior oral cavity and base of tongue is situated between the oral and pharyngeal stages of the swallow. Any treatment directed to that region is likely to affect tongue movement in the oral stages of the swallow, the triggering of the swallowing reflex (which occurs largely in the tonsil region), and pharyngeal peristalsis, since the medial constrictor attaches to the mandible and base of tongue at this point. The tongue base also plays a role in propelling the bolus through the oropharynx because it contributes to generating pressures in the oropharynx.

Surgical reconstruction that creates the greatest range of back and base of tongue movement will result in the best tongue control for swallowing. The patient will, however, still experience some delay in triggering the pharyngeal swallow and some degree of reduced pharyngeal peristalsis. Swallowing therapy can improve the triggering of the pharyngeal swallow, but the reduction in pharyngeal peristalsis is usually permanent.

The result of this reduced peristalsis is an inefficient swallow, that is, residual food left in the pharynx. When the patient inhales after the swallow, there is constant risk of aspirating this material. To prevent this aspiration, these patients usually repeatedly clear their throats as they eat to clear this residual material from around the laryngeal vestibule.

THE EFFECTS OF SURGICAL TREATMENT TO THE PHARYNX ON SWALLOWING

Surgical procedures to the pharyngeal wall will directly affect pharyngeal peristalsis. Pharyngeal peristalsis is responsible for clearing the pharynx of residual food at the end of the swallow. The pharyngeal peristaltic wave begins in the superior constrictor and progress sequentially through the middle constrictor to the inferior constrictor.¹¹ When

peristalsis is reduced or interrupted there will be residual food in the valleculae or on the pharyngeal walls or spread throughout the pharynx from the valleculae to the pyriform sinuses.

The pharyngeal peristaltic wave is designed to strip the pharynx of any residual food by following the bolus. Any surgical procedure that invades the pharyngeal wall will reduce the contraction of the pharyngeal constrictors and cause some food to collect or coat the pharynx in the area of the surgery. The larger the surgical resection, the greater the pharyngeal residue. When large portions of the pharynx are resected, peristalsis can be so severely compromised that the patient is unable to move any food through the pharynx. In addition to reducing pharyngeal peristalsis, surgical procedures that involve the lateral pharynx may contribute to laryngeal fixation so that the larynx does not elevate well during the swallow. When the larynx does not elevate well during deglutition, the epiglottis usually does not close as efficiently over the top of the larynx. Epiglottic closure is the least important aspect of airway protection, but it does prevent material from penetrating into the pharyngeal vestibule.

When the larynx does not elevate well and the epiglottis is in a more upright position during the swallow, pharyngeal peristalsis cannot clear residual food from around the epiglottis and laryngeal vestibule. Because the larynx is lower in the neck than it normally should be during the swallow, it tends to collect food. The patient easily inhales this residual food around the laryngeal vestibule after the swallow when the airway opens naturally. Any damage to the pharyngeal walls or to the external neck, which causes scar tissue, may restrict laryngeal elevation.

THE EFFECTS OF SURGICAL TREATMENT TO THE LARYNX ON SWALLOWING

Surgery to the larynx may have an effect on either laryngeal elevation or laryngeal closure, both actions critical to normal swallowing. During the pharyngeal stage of the swallow, the larynx elevates under the tongue base and moves anteriorly. This anterior movement and elevation places the larynx away from the bolus' path and contributes to UES opening by stretching the cricopharyngeal region. Cricopharyngeal opening involves four factors, the first two of which are most important: (1) relaxation of the cricopharyngeal muscle; (2) physical opening of the sphincter by the pull of the larynx on the cricopharyngeal region as the larynx moves upward and forward during the swallow; (3) compliance of

the cricopharyngeus muscle; and (4) suprasedgment pressure to drive the bolus through the segment. Cricopharyngeal muscle relaxation occurs a fraction of a second prior to opening of the cricopharyngeal region during the swallow.

The second laryngeal action critical to normal swallowing is laryngeal closure, which proceeds inferiorly to superiorly during swallow. This inferior to superior valvular closure results in the elimination of any food that may enter the laryngeal vestibule during the very earliest portion of the pharyngeal swallow. Of these three valves that comprise laryngeal closure, closure of the true vocal folds is most critical to airway protection. Any surgical procedure that significantly damages these three valves, but particularly the true vocal folds, will usually result in some degree of aspiration of food during the swallow, as the larynx (including the true vocal folds) allows food to penetrate into the trachea.

A) THE SUPRAGLOTTIC LARYNGECTOMY

The supraglottic laryngectomy can interfere with laryngeal elevation, and required that patient learn the supraglottic swallow sequence for a period of time.^{6,10,13,16,19,21,22}

The supraglottic swallow involves three steps: (1) taking a breath and holding the breath at the height of the inhalation, (2) swallowing while holding the breath, and (3) coughing after the swallow without taking a new breath.²⁴ Holding the breath closes the true vocal folds, thus protecting the airway. Coughing after the swallow clear any residue remaining in the pharynx. Learning this sequence is not easy for some patients and requires much practice and reinforcement by the speech language pathologist. Occasionally, some supraglottic laryngectomees have reduced vocal fold adduction, resulting in an inability to close the vocal folds well enough to protect the airway, even with the supraglottic swallow. These patients require laryngeal adduction exercises with non-oral feeding until they achieve sufficiently improved adduction to protect the airway. Then they can learn and use the supraglottic swallow.

If a laryngeal suspension procedure is included in the reconstructive portion of the supraglottic surgical procedure, the normal laryngeal elevation will be recreated, and swallowing generally will be more normal.⁷ In addition to damage to laryngeal suspension, the supraglottic laryngectomy may also cause edema in the are of the arytenoid cartilages. During normal swallow, the arytenoid tips forward as a contribution to laryngeal closure. This

action also gets the arytenoid our of the way of the esophageal inlet. When there is postoperative edema in the arytenoid, the cartilage cannot move as easily and is more prominent. This causes food to collect around the arytenoids during the swallow and increases the chance of aspiration of this residual food into the airway after the swallow. Initially, then, the supraglottic laryngectomee often aspirates after the swallow, rather than during the swallow. That is, the patient is able to maintain airway closure during the swallow by holding his breath, but because there is food clinging to the arytenoids after the swallow, the patient inhales this food into the airway on the inhalation that follows the swallow.

If the supraglottic laryngectomy resection is extended beyond what might be considered the traditional procedure including excision of the epiglottis, a small portion of base of tongue, hyoid, aryepiglottic folds and false vocal folds, the chance of the patient relearning to swallow is reduced. If the surgical resection is extended toward the arytenoid cartilage, the patient will have increased difficulty in maintaining airway protection and greater chance of aspiration during the swallow. If the patient's resection is extended anteriorly into the tongue base, the reduced tongue base may form a ramp that directs food toward the airway. In many supraglottic laryngectomees, the tongue base serves to deflect food away from the airway opening. When a larger segment of tonque base is resected, the airway receives less protection, and there is less tongue base movement to propel the bolus toward the esophagus. Thus, food tends to roll off the tongue directly into the airway.

B) THE HEMILARYNGECTOMY

In the hemilaryngectomy patient, the most frequent swallowing difficulty is reduced laryngeal closure because of loss of sphincteric action related to loss of one vertical half of the larynx. If the hemilaryngectomy procedure is limited to the false vocal fold, true vocal fold and ventricle on one side, the patient is generally able to compensate quickly for the tissue loss with a slight increase in adduction effort during swallow. If this is not sufficient, the patient can use a head-down posture, which places the epiglottis in a more overhanging position and directs food more posteriorly away from the airway. Also, turning the patient's head to the operated side will improve laryngeal closure by physically applying pressure to the operated or weaker side, thereby pushing the damaged vocal cord toward midline. In general, this posture works well for the hemilaryngectomee.

When the hemilaryngectomy procedure is extended beyond

the anterior commissure into the opposite vocal fold or into the arytenoid cartilage, the postoperative time required to rehabilitate swallowing lengthens and the patient usually must perform adduction exercises to improve the strength of laryngeal closure in order to prevent aspiration during the swallow. The patient is usually maintained on non-oral feeding during this period of time until laryngeal adduction becomes strong enough to prevent food from entering the larynx during the swallow.

C) THE TOTAL LARYNGECTOMY

In theory, the total laryngectomy should have only minimal changes in swallowing postoperatively. Since there is no chance of aspiration with the airway and pharyngo-esophagus physically separated, the greatest difficulty the total laryngectomy may have with deglutition is in propulsion of the bolus through the oral cavity and pharyngo-esophagus. Total laryngectomy patients often experience a mild change in tongue control of the bolus during chewing and during the oral stage of the swallow because of the loss of the hyoid bone as the foundation for the tongue.⁵ In addition, some data indicate that there is increased pressure in the pharyngo-esophagus after total laryngectomy, requiring the tongue to increase the pressure it generates to propel the bolus. A few total laryngectomees experience a stricture somewhere along the pharyngo-esophagus, which effectively narrows the food channel and can cause collection of food in the pharyngo-esophagus above the stricture. In some cases of stricture, food refluxes back into the mouth or into the nose, particularly when the patient attempts to drink large amounts of liquids.

Some total laryngectomees have a pseudopiglottis at the tongue base, which, if large enough, can significantly impair swallow. The pseudo-epiglottis is a fold of mucous membrane and sometimes scar tissue coming from the lateral pharyngeal wall into the base of the tongue.^{9,17} On lateral radiographic examination, this tissue has the contour of the epiglottis, thus the term "pseudo-epiglottis." At rest, this pseudo-epiglottis often collapses against tongue base, leaving adequate room between the tongue base and the posterior pharyngeal wall, which is misleading on mirror examination. During swallow, however, the pseudo-epiglottic tends to be pulled toward the posterior pharyngeal wall by pharyngeal contraction. This opens a large pocket between the tongue base and the pseudo-epiglottis. This pocket collects food and, in some cases, is large enough that the patient cannot pass food around it and through the pharyngo-esophagus.

SWALLOWING INTERVENTIONS FOR THE HEAD AND NECK CANCER PATIENT

Swallowing intervention for the head and neck cancer patient should begin preoperatively with counseling regarding the potential changes in eating and swallowing that are likely to occur after treatment. It is important that the patient realize that there will be changes in his or her eating and swallowing post - treatment and that he or she will be required to do exercises and work actively in therapy to improve his or her eating and swallowing. It is surprising, but many patients facing significant head and neck surgical procedures do not associate or understand that the surgery will affect their ability to eat as well as to talk. Though patients may be told that the surgery or treatment will involve their tongue, many will not associate changes in their tongue with changes in eating and swallowing. Usually, the speech - language pathologist will provide this pretreatment counseling regarding anticipated swallowing as well as speech changes. The counseling will consist of talking with patients about the changes in swallowing which may be caused by the treatment with emphasis on the availability of the speech - languages pathologist to work with the patients to improve their deglutition. It is also important for the patients to know their role in practicing and working actively in the therapy program. Patients who are aware of this responsibility preoperatively appear to cooperate more readily with the therapy program postoperatively.

Once the nature of the surgical procedure is understood postoperatively, the speech - language pathologist should talk in detail with the patient regarding the plan for swallowing rehabilitation. This rehabilitation process begins with radiographic evaluation of deglutition as soon as healing is complete.²³ It is becoming increasingly clear that a bedside examination of the patient's swallowing ability does not provide sufficient detail about the pharyngeal swallow or even the posterior oral swallow, to enable the speech - languages pathologist to work efficiently and effectively to restore more normal swallowing and eliminate non-oral feeding. In order to plan effective swallowing therapy, the speech - language pathologist must be able to assess all aspects of the physiology of the oral and pharyngeal stages of the swallow. This is not possible without videofluoroscopy. If possible, the patient's first postoperative swallowing attempts should be completed in radiology using videofluoroscopy under a careful, defined protocol.^{24, 25}

In this protocol, the patient is viewed laterally and given

small-calibrated amounts of material (initially 1cc per swallow). During the radiographic study, the patient is assured that a small amount of food will be given and that there should be no difficulty with it. The patient is instructed to do his or her best in swallowing and, if there is any difficulty, to cough and expectorate the material. The patient is then given the material, and the swallow is assessed radiographically in the lateral plane. The fluoroscopic tube is focused on the oral cavity and pharynx and does not follow the bolus, but remains focused on the oral cavity and pharynx after the swallow in order to determine: (1) whether the patient aspirates after the swallow; (2) whether any residue remains in the pharynx after the swallow; and (3) whether the patient coughs in response to any aspiration or dry swallow in response to any residue.

The patient's physiologic reactions are important in identifying sensory disorders in the oral cavity and pharynx. Normal individuals with pharyngeal residue will immediately dry swallow to clear this material, because they have the sensation of food remaining in the pharynx. If the patient does not immediately attempt to dry swallow in the presence of residue, it indicates reduction in pharyngeal sensation. If the patient aspirates at any time before, during, or after the swallow, there should be an immediate reflexive cough. If there is no reflexive cough, it indicates reduced sensation in the larynx. Both of these pieces of information on sensory function are important in managing the patient in swallowing therapy and moving the patient toward recovery of oral intake.

After the patient has been given a small amount of liquid (1cc) per swallow, the size of the bolus should be enlarged to 3cc, 5cc, and 10cc, if the patient is able to manage without aspiration. Then the patient should be given small amounts of thick liquid, paste, and cookie (masticated material) to chew and swallow, the nature of the patient's swallowing physiology should be defined, and a therapy program outlined. From that point forward, the patient should receive daily swallowing therapy in the hospital with exercise to practice independently 5 to 10 times per day. When the clinical working with the patient perceives that the patient has improved in swallowing physiology at the bedside, the patient's swallow should be rechecked radiographically. When patients are discharged from the hospital, they should be given weekly swallowing therapy with exercise programs to practice at home 5 to 10 times per day. At this time, maxillofacial prosthetic intervention may begin for patients with reduced lingual function resulting from resection or

reconstruction. The introduction of a palatal reshaping/augmentation prosthesis may improve the patient's speed of swallow and allow the patient to control food in the mouth, thereby expanding diet options. 8.

Once the assessment of swallowing physiology indicates that the speed of the oral and pharyngeal swallow is sufficient to provide adequate calories orally (less than 10 seconds per swallow), and that there is minimal aspiration (no more than a small amount), the patient may begin oral feeding. There is no need to pull a nasogastric tube to test the patient's ability to maintain oral intake. It will be clear from the radiographic study whether the patient can indeed maintain adequate oral intake based upon the speed of the swallow through the oral and pharyngeal stages and the amount of aspiration. Pulling a patient's nasogastric tube to see if he or she can swallow only results in frustration on the patient's part, and a feeling of complete failure when the tube must be replaced. Good communication between the speech - language pathologist / swallowing therapist and the surgeon will assure that the patient's swallowing rehabilitation proceeds optimally.

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