



Managing Swallowing Disorders in Children

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Dysphagia or impaired swallowing may severely affect a child's development or quality of life. It can make children permanently dependent on being fed by others or on non-oral nutritional support. It can pose the constant threat of sudden obstruction of the airway or of respiratory infections secondary to aspiration. Along with general examination, evaluation by a specialist in ENT should provide information on general health and social and cognitive ability.

Swallowing may be impaired because of mechanical impediment to passage of the bolus, lack of salivary secretions, weakness in muscular structures propelling the bolus, or dysfunction of neuronal networks coordinating swallowing. Several complex mechanisms are required to achieve control in physiologic functioning of the upper aerodigestive tract in respiration, phonation, swallowing, and protection of the airway. A disorder that has an effect on neurologic control, muscular strength, or local anatomy of the upper aerodigestive tract can affect these functions, causing chronic aspiration.

Pharyngeal and esophageal disorders such as gastroesophageal reflux may result in aspiration. Children may suffer aspiration as a result of congenital anatomic abnormalities such as clefts and tracheoesophageal fistulas, as well as from neurological diseases or syndromes. Chronic and recurrent pulmonary aspiration may be secondary to dysfunctions in swallowing, gastroesophageal reflux, or lack of competence of the glottis. The differential diagnosis may include many respiratory diseases in children. Consequences can include progressive injury to the lungs, recurrent pneumonia, respiratory failure, or death.

The incidence of swallowing disorders in children with neurological diseases or multiple disabilities is 32% to 80% (neuromuscular disease 32-51%, severe motor disability 80%, cerebral palsy 47%). Clinical presentation of disorders in swallowing is not specific: sialorrhea, failure to thrive, wheezing, chronic cough, recurrent pneumonia, choking, malnutrition, fever, dyspnea, dysphonia, frequent throat-clearing, chest pain, dysphagia, odynophagia, regurgitation of feedings, and emesis. Further, the presentation may be as silent aspiration with no presenting symptoms or signs until complications develop.

Differential diagnosis can compare the condition to GER (gastroesophageal reflux) which is frequently associated with oropharyngeal dysphagia and respiratory diseases. The gold standard in methods of testing is 24 hours of monitoring

of esophageal pH, but this monitoring cannot confirm a diagnosis between acid and non-acid reflux. Methods such as multichannel impedance and monitoring of pH and scintigraphy are complementary.

Diagnostic methods

1. Videendoscopy of deglutition (VED): Functional endoscopic evaluation of swallowing (FEES) involves positioning the nasopharyngoscope posterior to the soft palate. Then the patient is fed. Sensory tests can be performed. Aspiration immediately before and after deglutition can be evaluated. (**Table 1**)
2. Videofluoroscopy of swallowing (VSS) or modified barium-swallowing: Is considered standard in the study of swallowing function. The image is adjusted to view the area from the lips to the cervical esophagus. Manometry used with videofluoroscopy can identify cricopharyngeal dysfunction. (**Table 1**)

Table 1. Diagnostic methods

	VSS	FEES or VED
Benefits	All phases of swallowing	Anatomy Airway protective reflexes Bedside No radiation
Limitations	Radiation exposure No bedside No anatomy	Blind esophageal phase Not physiological?

3. Radionuclide scintigraphy: The patient swallows a small amount of water containing technetium-99m. The radiologist can calculate the percentage of aspiration. Radionuclide salivagrams are the most sensitive test for aspiration of saliva, although there are other methods such as suction of dye-stained tracheal secretions in children who have had previous tracheostomy or tests with VED or FEES.

4. Bronchoalveolar lavage (BAL) to calculate the lipid-laden macrophage index (LLMI) is a standardized and diagnostically sensitive procedure for diagnosing CPA in children. The results are not specific in children.

5. Thoracic CT-scan with high resolution (HRCT scan) provides clinically helpful information. Morbidity after surgical control of aspiration is correlated with severe alterations on an HRCT scan. Altered results include oblitative bronchiolitis, mosaic pattern of attenuation, air-trapping, bronchiectasis, centrilobular opacities, bronchial thickening. These results are specific to aspiration, but could demonstrate prognosis for treatment of the aspiration.

Clinical treatment

Therapy for aspiration is determined by its severity, repercussions, and whether aspiration is direct or due to reflux. Compensatory strategies include positioning, thickening liquids, stimulating swallows, and improving pharyngeal clearance. Some patients will need feeding by a nasoenteral tube and then by gastrostomy or

jejunostomy. There has been considerable debate in published reports regarding the benefits of a routine anti-reflux procedure at the time of placement of a gastrostomy tube. There is little evidence that morbidity or mortality are increased in children who do not undergo preventive fundoplication.

For children with chronic pulmonary aspiration (CPA) due to GERD (gastroesophageal reflux disease), medical and conservative therapies are chosen initially. Feeding thickened substances decreases the frequency and height of nonacid-reflux events but not of acidic events. Effective prokinetic agents are limited. Proton-pump inhibitors (PPI) therapy have been widely used to decrease acid reflux, and their side-effects are low. But for many children with CPA due to GER, medical therapy does not result in improvement in injuries to the lower respiratory tract. Fundoplication has become the anti-reflux procedure of choice in children with persistent or severe respiratory symptoms and GER. The outcome of fundoplication is generally good.

Surgical Treatment

Surgical management of chronic aspiration is based on concepts of a shared upper airway for functions of swallowing and respiration. Before 1972, laryngectomy was routinely chosen to separate these functions when there was chronic aspiration. In 1972, Habal and Murray described a procedure to close the larynx that involved creation of an epiglottic flap. In 1975, Lindeman described his experience with a reversible technique that diverted the larynx to the esophagus and the trachea to the neck as a stoma. He subsequently performed this procedure with a modification, laryngotracheal separation (LTS), closing the proximal trachea in a dead-end shape.

Since then, as diagnostic and therapeutic techniques have become more sophisticated, more specific procedures have been developed to treat specific pathologic conditions. The ideal surgical technique to treat chronic aspiration, especially in children, should prevent complete aspiration in one single surgical episode, be safely conducted in small structures, preserve the integrity of the larynx without causing damage or scars that would prevent growth, allow phonation, and allow revision of the procedure. There are several procedures available.

Vocal fold medialization: This procedure is used when there is aspiration secondary to unilateral vocal fold paralysis or atrophy of vocal folds with inadequate glottic closure. Medialization can be done using augmentation of the mass of the vocal fold or by thyroplasty type 1 (the laryngeal framework approach).

Cricopharyngeal (CF) myotomy: Is performed when the passage of a bolus to the esophagus is broken, secondary to sustained contraction of the cricopharyngeal muscle during swallowing. This condition is associated with Zenker diverticulum and oculopharyngeal muscular dystrophy.

Gastrostomy (percutaneous endoscopic or surgical), jejunostomy, and gastric fundoplication: These procedures are indicated in patients with dysphagia, chronic aspiration and malnutrition. Gastric fundoplication is the treatment for reflux and for re-creation of the sphincteric mechanism.

Control of salivation: Aspiration of salivary secretions can be a source of aspirated materials. The local injection of botulinum toxin type A (TBA) into salivary

glands can temporarily reduce salivary secretions. Injection of BTA is a minimally invasive and temporary alternative treatment for drooling in children, but controlled studies of dose-escalation are urgently needed to establish the dose-dependent efficacy and safety of this treatment in children. The gold standard for a surgical procedure is bilateral excision of submandibular glands and ligation of parotid ducts for long-term reduction of saliva.

Tracheotomy: A tracheotomy does not prevent aspiration, but is indicated in both chronic aspiration and pulmonary complications requiring sustained ventilatory support, obstruction of the upper airway, obstructive sleep apnea, and pulmonary hygiene.

Laryngotracheal separation (LTS): If restriction of oral feeding and treatment of gastroesophageal reflux disease are not enough to prevent respiratory complications and lung-infections from aspiration, it is necessary to isolate the lower respiratory airways surgically from upper aerodigestive airways in order to prevent aspiration of saliva and secretions. A LTS is safe and effective when performed in children.

The decision on dysphagia treatment in children could be done, the personal experience, on basis of the level of pulmonary disease and the presence or not of previous tracheostomy, as could be resumed:

Children with no previous tracheostomy or with mild/moderate pulmonary disease:

- Reduction of saliva using drugs, TBA, or surgical treatment
- Behavioral or postural approaches
- Gastrostomy or jejunostomy
- Cricopharyngeal dysfunction
- Vocal fold medialization in cases of vocal folds paralysis with glottis closure incompetence.

Children with previous tracheostomy or severe pulmonary disease:

- Tracheo tube with cuff
- Endolaryngeal stent
- Larynx closure
- Laryngotracheal separation (LTS)

Recommended readings

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5. Manrique D, Settanni FAP, Brasil, OOC. Surgery for aspiration: analysis of laryngotracheal separation in 23 children. *Dysphagia* 2005; 20 (1): 77-86.
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7. Manrique D, Sato J. Salivary gland surgery for control of chronic pulmonary aspiration in children with cerebral palsy. *Int J Pediatric Otorhinolaryngol* 2009; 73(9): 1192-1194.