

Supraglottoplasty

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1. General Considerations

- a. Indications
 - i. Severe laryngomalacia diagnosed on flexible fiberoptic laryngoscopy¹
 - ii. Symptoms and signs of severe laryngomalacia, including²:
 - a. Airway obstruction
 - 1. Stridor
 - 2. Supraglottic collapse partially or completely obscuring view of vocal cords on laryngoscopy
 - 3. Deep retractions/pectus deformity
 - 4. Apneic/cyanotic spells
 - 5. Obstructive sleep apnea on polysomnography
 - 6. Pulmonary hypertension or cor pulmonale
 - b. Feeding difficulty
 - 1. Failure to thrive / poor weight gain
 - 2. Regurgitation / aspiration
 - c. Gastroesophageal reflux disease and laryngopharyngeal reflux
 - 1. Most common medical comorbidity in infants with laryngomalacia
 - d. Surgery usually reserved for severe cases refractory to treatment (acid suppression, thickened feeds)
- b. Contraindications
 - i. Multilevel airway obstruction
 - ii. Relative: neuromuscular disease / hypotonia. Weigh improvement in airway obstruction against risk of worsening aspiration³
 - iii. Active upper or lower respiratory tract infection
- c. Advantages
 - i. Supraglottoplasty shortens length of symptomatic disease compared to wait-and-see⁴ for severe laryngomalacia
- d. Pertinent Anatomy

¹ Bedwell J, Zalzal G. Laryngomalacia. *Semin Pediatr Surg*. 2016;25(3):119–122. doi:10.1053/j.sempedsurg.2016.02.004

² Thompson DM. Laryngomalacia: factors that influence disease severity and outcomes of management. *Curr Opin Otolaryngol Head Neck Surg*. 2010;18(6):564–570. doi:10.1097/MOO.0b013e3283405e48

³ Carter J, Rahbar R, Brigger M, Chan K, Cheng A, Daniel SJ et al. International Pediatric ORL Group (IPOG) laryngomalacia consensus recommendations. *Int J Pediatr Otorhinolaryngol* 2016; 86:256 – 61

⁴ Van der Heijden, M., Dikkers, F.G. & Halmos, G.B. Treatment outcome of supraglottoplasty vs. wait-and-see policy in patients with laryngomalacia. *Eur Arch Otorhinolaryngol* 273, 1507–1513 (2016). <https://doi.org/10.1007/s00405-016-3943-3>

- i. Epiglottis: Thin elastic fibrocartilage structure that projects up behind the tongue and body of hyoid bone, partly covers laryngeal entrance. Sides are attached to arytenoid cartilages by aryepiglottic folds.
- ii. Arytenoid Cartilage: Two pyramidal hyaline cartilages at upper border of cricoid cartilage in posterior larynx. On the apices sit the corniculate cartilages.
- iii. Aryepiglottic Folds: Triangular folds of mucous membrane extending from the lateral borders of the epiglottis to the arytenoid cartilages.
- iv. Cuneiform cartilage: Small, paired cartilage which resides in the aryepiglottic fold.
- e. Multiple classification systems exist to characterize laryngomalacia, describe mucosal vs cartilaginous collapse, and define which anatomical structures are involved. The Olney classification is as follows⁵:
 - i. Type 1: Prolapse of mucosa overlying the arytenoid cartilages
 - ii. Type 2: Foreshortened arytenoid cartilages
 - iii. Type 3: Posterior displacement of the epiglottis

2. Preoperative preparations

- a. Evaluation:
 - i. History: Duration and severity of stridor, feeding or respiratory difficulties, apnea, cyanosis, tachypnea, obstructive sleep apnea, failure to thrive, aspiration/pneumonia, or cor pulmonale.
 - ii. Diagnosis confirmed by flexible laryngoscopy + symptoms
 - iii. Consider formal swallow evaluation
 - iv. Patients may be considered candidates for surgery when medical management has failed as evidenced by failure to thrive, acute life-threatening events, or frequent unplanned visits to the doctor's office for airway complaints
- b. Consent for surgery
 - i. Potential complications⁶:
 - 1. Intraoperative:
 - a. Injury to local structures: Epiglottis, esophagus
 - b. Bleeding
 - 2. Early:
 - a. Infection
 - b. Granuloma
 - c. Airway edema
 - d. Feeding difficulties including choking and aspiration

⁵ Olney DR, Greinwald JH Jr, Smith RJ, Bauman NM. Laryngomalacia and its treatment. *Laryngoscope*. 1999; 109(11):1770-5

⁶ Denoyelle F, Mondain M, Grésillon N, Roger G, Chaudré F, Garabédian EN. Failures and Complications of Supraglottoplasty in Children. *Arch Otolaryngol Head Neck Surg*. 2003;129(10):1077–1080. doi:10.1001/archotol.129.10.1077

3. Late:
 - a. Fibrous webs
 - b. Supraglottic stenosis
 - c. Aspiration

3. Nursing Considerations

- a. Room Setup:
 - i. Head turned 90 degrees counterclockwise from anesthesiology (patient's left shoulder at anesthesia machine) as for all rigid bronchoscopy
 - ii. Mayo stand for suspension
- b. Instrumentation and equipment
 - i. Microlaryngeal instruments
 - ii. Operative microscope (focal length 400 mm)
 - iii. Benjamin-Lindholm scope or Parsons laryngoscope and suspension apparatus
 - iv. Pledgets
 - v. CO2 laser or laryngeal microdebrider if applicable. Authors prefer "cold steel" technique for primary supraglottoplasty
- c. Medications (Specific to nursing)
 - i. 1% lidocaine
 - ii. Oxymetazoline (for pledgets)
- d. Prep and drape
 - i. Consider shoulder roll to facilitate neck extension (if no Down syndrome or other contraindication)
 - ii. Tape patient's eyes
 - iii. Mouth guard or wet gauze to protect the teeth/ maxillary alveolus

4. Anesthesia Considerations

- a. General
 - i. Bed turned 90° counterclockwise from the anesthesiologist
 - ii. General anesthesia with spontaneous ventilation in most cases. Oral or nasotracheal intubation may be necessary in some cases
- b. Perioperative steroids
 - i. 0.5mg/kg dexamethasone before endoscopy to minimize perioperative edema.

5. Operative Procedure

- a. When plane of anesthesia is adequate, protect upper dentition and perform direct laryngoscopy and rigid bronchoscopy⁷
 - a. Laryngotracheal anesthesia: spray 1% topical lidocaine solution (4-5 mg/kg) to decrease risk of laryngospasm
 - b. Rigid telescope (without ventilating bronchoscope) adequate for majority of cases
 - c. Allows for pre-intervention assessment of supraglottic collapse and evaluation of concomitant pathology such as laryngeal cleft, subglottic stenosis, tracheal stenosis, tracheo- or bronchomalacia.
- b. Expose larynx with Parsons or Lindholm laryngoscope, place in suspension
- c. Maintain oxygenation (blow-by, 3.0 endotracheal tube connector inserted into laryngoscope suction evacuator, or endotracheal tube in pharynx). *If using laser, follow laser precautions (FiO₂, wet gauze over eyepads, wet towels around face)
- d. Use operating microscope (400mm lens) for visualization
- e. Surgical resection can be performed using microlaryngeal scissors, carbon-dioxide (CO₂) laser, or microdebrider⁸. Address affected structures as follows:
 - a. Shortened Aryepiglottic folds (type 2 laryngomalacia)
 - i. Grasp and retract arytenoid mucosa posteromedially with microlaryngeal forceps, placing tension on the aryepiglottic fold
 - ii. Incise aryepiglottic fold along the lateral edge of the epiglottis
 - iii. A small vessel is often encountered at the inferior limit of dissection. Apply pressure with cotton pledgets with oxymetazoline (or saline) for hemostasis
 - b. Redundant arytenoid mucosa or cartilage (type 1 laryngomalacia)
 - i. Grasp and retract arytenoid mucosa anterolaterally with microlaryngeal forceps
 - ii. Microscissors and laser: make medial incision first to avoid inadvertent interarytenoid mucosal stripping. Maintain grasp on redundant arytenoid tissue and retract medially. Make lateral/posterior-to-anterior incision, connect it to medial incision.
 - iii. Microdebrider: 3000 rpm skimmer setting, gently debulk posterolateral mucosa (avoid interarytenoid space)
 - c. Avoid multiple re-grasps to minimize edema
 - d. Preserve interarytenoid mucosa and normal strip of mucosa between arytenoid and AE-fold incisions to prevent scarring and stenosis

⁷ Rawlings, B. A., Derkay, C. S., Chu, M. W., & John, J. (2009). Surgical treatment of laryngomalacia. *Operative Techniques in Otolaryngology-Head and Neck Surgery*, 20(4), 222–228. doi: 10.1016/j.otot.2009.10.017

⁸ TRuong M.T., Messner, A (2015) Evaluation and Management of the Pediatric Airway. In: Flint PW, Haughey BH, Lund VJ, Niparko JK, Robbins KT, Thomas JR et al (eds) Cummings otolaryngology, head and neck surgery, 6th ed. Elsevier Saunders, Philadelphia

6. Postoperative Care⁹

- a. Overnight admission to a monitored unit with continuous pulse oximetry. HOB 30 degrees.
- b. Airway control:
 - a. Intubation, though unlikely, is sometimes required overnight in young infants
- c. Medications:
 - a. If postoperative stridor or respiratory distress (laryngeal edema), consider dexamethasone 0.5 mg/kg POD 1 and/or racemic epinephrine
 - b. PPI or H2 blocker
- d. Feeding: Once fully awake, proceed with regular feeding if no significant aspiration history. If feeding issues, consult a swallowing therapist. If severe aspiration, a temporary nasogastric tube may be required.
- e. Reassess at 1 and 3 months to evaluate GERD/LPR, airway obstruction, and feeding disorders

7. Suggested reading:

- a. Bedwell J, Zalzal G. Laryngomalacia. *Seminars in Pediatric Surgery*. 2016 Jun;25(3):119-122. DOI: 10.1053/j.sempedsurg.2016.02.004
- b. Carter J, Rahbar R, Brigger M, Chan K, Cheng A, Daniel SJ et al. International Pediatric ORL Group (IPOG) laryngomalacia consensus recommendations. *Int J Pediatr Otorhinolaryngol* 2016; 86:256 – 61
- c. Denoyelle F, Mondain M, Grésillon N, Roger G, Chaudré F, Garabédian EN. Failures and Complications of Supraglottoplasty in Children. *Arch Otolaryngol Head Neck Surg*. 2003;129(10):1077–1080. doi:10.1001/archotol.129.10.1077
- d. Rawlings, B. A., Derkay, C. S., Chu, M. W., & John, J. (2009). Surgical treatment of laryngomalacia. *Operative Techniques in Otolaryngology-Head and Neck Surgery*, 20(4), 222–228. doi: 10.1016/j.otot.2009.10.017
- e. Richter, G. T., & Thompson, D. M. (2008). The Surgical Management of Laryngomalacia. *Otolaryngologic Clinics of North America*, 41(5), 837-864. <https://doi.org/10.1016/j.otc.2008.04.011>

8. CPT Code:

No specific code exists. Discuss with your billing department. Consider 31541 (direct laryngoscopy with biopsy) vs 31588 (unlisted code).

⁹Richter, G. T., & Thompson, D. M. (2008). The Surgical Management of Laryngomalacia. *Otolaryngologic Clinics of North America*, 41(5), 837-864. <https://doi.org/10.1016/j.otc.2008.04.011>