



Surgical management of velopharyngeal dysfunction



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Velopharyngeal insufficiency can be a postoperative sequela or congenital. Velopharyngeal insufficiency is defined as a degree of nasality that interferes with resonance quality and comprehensibility. The diagnosis and preoperative evaluation is contingent on collaborative evaluation between the surgeon and speech-language pathologist. A thorough history and a complete head and neck examination including a videotaped nasopharyngoscopy optimize planning. Although each patient varies greatly in their presentation, we provide a review of the most commonly implemented procedures to improve velopharyngeal insufficiency and the best way to recognize which will likely improve a patient's condition based on preoperative evaluation.

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Introduction

Velopharyngeal insufficiency is important to recognize in the long-term care of patients with a history of a cleft palate. Despite surgical repair of the cleft, approximately 20% of these patients demonstrate velopharyngeal insufficiency owing to either inadequate velar length following the repair or velopharyngeal incompetence due to poor muscle function.¹ Additionally, a minority of patients with submucous clefts and neuromuscular disorders also present with dysfunction.² Velopharyngeal insufficiency is defined as a degree of nasality that interferes with resonance quality and comprehensibility. This article describes the evaluation of these patients and discusses options for treatment.

Patient evaluation

Hypernasality typically becomes evident once speech becomes developed, and often caregivers or teachers initiate

concerns regarding speech. A full evaluation is often impractical before 4 years of age owing to the absence of language development and patient cooperation. However, once a cooperative age is reached, the palate and oropharynx should be carefully examined noting tonsil size, the presence of any oronasal fistulas, and sites of previous surgeries. The presence of a zona pellucida of the soft palate and absence of a posterior nasal spine suggest a submucous cleft palate. Abnormal nasal air escape can be visualized with a dental mirror placed below the naris during nonnasal sounds.

Speech is best evaluated with a speech pathologist noting degree of overall intelligibility, articulation errors, and evidence of velopharyngeal dysfunction. The presence of hypernasality and hyponasality can at times be confusing. Occluding the nostrils producing hyponasality can aid in distinguishing the 2. After appropriate speech therapy, patients with intelligibility issues should be evaluated with a flexible nasopharyngoscopy and laryngoscopy following administration of topical lidocaine and oxymetazoline decongestant with a well-experienced speech-language pathologist. Vocal nodules and evidence of reflux are often seen in this patient population as well.

Velopharyngeal function is evaluated by placing the scope high in the nasopharynx via the middle meatus. The

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evaluation should include type of closure, coronal (most common), sagittal (least common), and circular, including the presence of Passavant ridge (horizontal contraction of the superior constrictor, which produces a bulge in the posterior pharyngeal wall). Lateral wall and palatal motion should be scored using the Golding-Kushner's scale or similar^{3,4} (Table 1). The presence of a midline palatal notch indicates a dehiscence of the levator veli palatini seen in submucosal cleft palates and can be noted after primary palate repair. The level of maximum closure, particularly as it relates to the adenoid bed also influences treatment. Ultimately, one needs to know where air is leaking and choose a surgical procedure directed there.

On nasopharyngoscopy, the palatal length, width, and tightness of closure are assessed. When insufficiency is present, the size and shape of the persistent defect should be noted. Some patients who may benefit from surgical intervention may have touch closure with bubbling with speech tasks. Air escape can be visualized at the level of the nasopharynx while asking the patient to say statements demonstrating velopharyngeal competence, such as "Sissy sees the sky," and counting from "62 up to 68."¹ An attempt is made to avoid sounds that typically have nasal escape, such as /m/, /n/, and /ng/. Using plosives, such as "Pop," and "Cop," can make further assessment, as these simple sounds promote closure. Using both more complex and lengthier sentences can further delineate function. This evaluation dictates the type of surgical repair. If a pharyngeal flap is indicated, port size should be determined at this time and documented in the child's medical record (Table 2).

Surgical options

The 3 most common procedures used by cleft surgeons include the pharyngeal flap, sphincter pharyngoplasty, and Furlow palatoplasty. The pharyngeal flap is the original procedure of choice and is ideal for patients with good lateral wall motion where a relatively narrow flap can be used. The sphincter pharyngoplasty is ideal in a patient with excellent palatal motion and little lateral wall motion. The Furlow palatoplasty is ideal for patients who leak through a midline palatal notch or a shortened velum. There is debate among surgeons between pharyngeal flap and sphincter pharyngoplasty for those patients with little motion in any direction.

Table 1 Golding-Kushner scale (subjective scaled scoring system)

Right lateral wall movement	0-0.5 [*]
Left lateral wall movement	0-0.5 [*]
Right palatal movement	0-1.0 [†]
Left palatal movement	0-1.0 [†]
Posterior pharyngeal wall movement	0-1.0 [‡]

*0 = no movement, 0.5 movement to midline.

†0 = no movement, 1.0 = movement to posterior pharyngeal wall.

‡0 = no movement, 1.0 = movement to soft palate.

Table 2 Nasal port size (4-5 year old)

3.5	Narrow and no motion
4.0	Medium and some motion
4.5	Large and good motion

Pharyngeal flap

The patient should be screened for signs and symptoms of obstructive sleep apnea, and a polysomnogram should be used when there are concerns. If a patient does in fact have sleep apnea, severity may preclude proceeding with a pharyngeal flap. The goal of the pharyngeal flap is to create a central subtotal velopharyngeal obstruction, leaving 2 lateral ports for residual nasal airflow.² We typically recommend a staged procedure of tonsillectomy and adenoidectomy 3 months before the pharyngeal flap as respiratory disturbances can typically worsen after the flap. Some report proceeding without the need for a staged procedure.³ The disadvantages of not removing the tonsils and adenoid include port obstruction by the tonsils or adenoid, and the adenoid pad limiting how high cephalad the base of the flap can be, typically missing the level of maximum velopharyngeal function.

Technique

The patient is placed supine in the Rose position. A shoulder roll is placed to provide adequate neck extension. Placing the patient in Trendelenburg position can assist with both decreased need for suctioning at the conclusion of the case and the surgeon's ergonomics. It is important that a thorough examination and palpation of the posterior pharyngeal wall be done especially in patients with velocardiofacial syndrome to identify medialization of the carotid arteries that can occur in this subset of patients.⁵ If the carotid becomes exposed, myomucosal coverage is necessary. The senior author typically injects the posterior pharyngeal wall with 0.25% bupivacaine with 1:200,000 of epinephrine. Adequate local injection can be indicated by evidence of mild hydrodissection of the mucosal plane. It is important to inject before proceeding with formal draping and instrument setup to allow for time for effective hemostasis by the vasoconstrictor. With the use of a fine marking pen or methylene blue dye placed on a carved wooden tip of a cotton swab, one can then demarcate the lateral borders that will provide adequate width, taking into account contraction of the flap that will occur with healing. Narrow ports require that lateral incisions extend to the lateral gutter (junction of the posterior and lateral pharyngeal wall), whereas with wider ports, the lateral incision should be 5-8 mm from the lateral gutter. It is critical to avoid making the flap too narrow even if the inset is narrow as the flap contracts significantly. The distal demarcation will taper inferiorly to a triangular point and coincide with the site of attachment to the soft palate (or velum) (Figure 1). Riski et al⁶ recommend positioning of the pharyngoplasty flaps with reference to the anatomical

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