Outcomes of Sphincter Pharyngoplasty and Palatal Lengthening for Velopharyngeal Insufficiency

A 10-Year Experience

Michael P. Carlisle, MD; Kevin J. Sykes, MPH; Virender K. Singhal, MD

Objective: To report our experience in the care of patients treated for velopharyngeal insufficiency (VPI) with sphincter pharyngoplasty (SP) with or without the addition of palatal lengthening by Furlow palatoplasty (FP).

Design: Retrospective analysis.

Setting: Tertiary care cleft palate and craniofacial clinic.

Patients: Forty-six children with VPI, most of whom had palatal clefts, treated with SP (1998-2008).

Interventions: Treatment consisted of SP alone (n=20) or SP plus FP (n=26).

Main Outcome Measure: Rate of revision surgery, indicating persistent VPI after surgical treatment.

Results: Of 46 patients, 6 (13%) required surgical revision. Regarding need for revision, no statistically significant differences were found concerning age, sex, cleft type, syndrome, or time between palate repair and SP. Indications for revision included persistent hypernasality (n=2), inferior position (n=2), flap dehiscence (n=1), and obstructed sleep (n=1). Postoperative improvement in velopharyngeal competence was documented in all revision cases. No patients required a second revision. Twenty-six of 46 patients (57%) underwent FP in addition to SP. The remaining 20 patients (43%) had SP alone. The revision rate was 4% (n=1) for the SP plus FP group and 25% (n=5) for the SP alone group (P=.04).

Conclusions: Sphincter pharyngoplasty is an effective procedure for the management of VPI, with a success rate of 87% when using need for surgical revision as the primary outcome measure. This number improved to 100% after a single revision, with elimination of VPI in all revision cases. Concomitant FP and SP may improve outcomes compared with SP alone. Further prospective studies are needed to elucidate this relationship.


VELOPHARYNGEAL INSUFFICIENCY (VPI) is characterized by hypernasality, nasal air emission, and, oftentimes, secondary facial grimacing in a compensatory effort to minimize nasal air escape. Nonspeech symptoms, such as nasal regurgitation during deglutition, can also occur. Velopharyngeal insufficiency results from a deficit at the nasopharyngeal level, where adequate velopharyngeal (VP) closure cannot be accomplished for any number of functional or structural derangements. Most commonly, VPI is seen in children born with palatal clefts, occurring in 20% to 30% of patients after primary palatoplasty.1,2

Surgical management of VPI aims to diminish nasal airflow during speech by allowing closure of the VP port while maintaining upper airway patency. Many modifications have been made in the surgical management of VPI since Passavant first introduced the attachment of the posterior velum to the posterior pharyngeal wall in 1862. Surgical options can be classified as palatopharyngeal, pharyngeal, or palatal procedures.

The mainstay of palatopharyngeal procedures is the posterior pharyngeal flap (PF), which creates 2 lateral nasopharyngeal ports by attaching the posterior aspect of the superior constrictor muscle to the soft palate. Favorable outcomes have been achieved with the PF,4,5 and it has become the workhorse of surgical VPI management for many surgeons. Pharyngeal procedures include sphincter pharyngoplasty (SP). Despite many modifications during the years,6-8 SP aims to narrow the nasopharynx, thereby enabling VP closure.9 This is accomplished by creating superiorly based lateral pharyngeal myomucosal flaps. Outcomes after SP have been favorable in several
retrospective studies\(^5\)\(^-\)\(^11\) using the rate of surgical revision (11.5%-16%) as the primary measure. In addition, recent prospective studies\(^1\)\(^2\)\(^,\)\(^3\)\(^13\) comparing PF and SP have not shown a significant difference in outcomes, although the cohorts were small. However, we favor SP over PF because of surgical preference and because of our perception of increased obstructed sleep symptoms associated with PF. Indeed, studies\(^1\)\(^4\)\(^-\)\(^1\)\(^1\) have noted a higher likelihood of obstructive sleep symptoms in patients who had PF.

Palatal procedures are designed to lengthen and perhaps thicken the soft palate, thereby contributing to VP closure with a low risk of obstructed breathing.\(^5\)\(^,\)\(^1\)\(^5\)\(^-\)\(^1\)\(^6\) The Furlow palatoplasty (FP) is probably the most widely used and is our exclusive choice for palatal lengthening when used for the treatment of VP. The use of FP alone for the management of VP in patients with submucous cleft palate and previously repaired cleft palate has been successful at other institutions.\(^1\)\(^7\)\(^-\)\(^1\)\(^8\) Recent reports have suggested increased efficacy of concomitant SP and FP for the management of VP, especially in patients with a large gap on nasendoscopy.\(^1\)\(^9\)\(^,\)\(^2\)\(^0\)

For selected patients with VPI, we often perform concomitant SP and FP at the Craniofacial–Cleft Palate Center at Children’s Mercy Hospitals and Clinics, Kansas City, Missouri. For primary repair of the cleft palate, we use the 2-flap palatoplasty almost exclusively, with FP being reserved for lengthening in cases of VP. The objectives of this study were to evaluate the success of SP at our institution when using need for surgical revision as the primary outcome measure and to compare these findings with similar retrospective studies. In addition, we aimed to evaluate whether performing FP for VPI treatment (after cleft palate repair) in addition to SP affects these outcomes.

A retrospective assessment was undertaken of all the patients who underwent SP by one of us (V.K.S.) for VPI between January 1, 1998, and December 31, 2008. All the patients were evaluated by the multidisciplinary team in the Craniofacial–Cleft Palate Center at Children’s Mercy Hospitals and Clinics, Kansas City, Missouri. Institutional review board approval was obtained before review of the medical record. Variables collected included race, ethnicity, sex, diagnosis, cleft type, and age at primary palatoplasty (if appropriate); syndrome; preoperative speech assessment, including subjective class of VPI (mild, moderate, or severe) and closure pattern; age at SP; previous, concomitant, or subsequent palatal lengthening; secondary or tertiary procedures; and postoperative speech assessment for those requiring surgical revision.

### METHODS

Of 46 patients, 6 (13%) underwent surgical revision. According to diagnosis, the revision group was composed of the following: cleft palate \((n=4, 67\%)\), submucous cleft palate \((n=1, 17\%)\), and VPI of noncleft origin \((n=1, 17\%)\). Indications for revision surgery were as follows: persistent hypernasality \((n=2)\), inferior flap position \((n=2)\), flap dehiscence \((n=1)\), and obstructed sleep \((n=1)\). The median interval between SP and revision was 19 months (range, 3-153 months).

Twenty-six of 46 patients (57%) underwent FP in addition to SP. The remaining 20 (43%) had SP alone. Re-
vision rates for these 2 groups were significantly different (SP alone: 5 patients [25%]; SP and FP: 1 patient [4%]; \( P = .04 \), Fisher exact test). All 6 patients who underwent revision had improvement in VP competence on postrevision (3 months) perceptual speech evaluation. No patients required a second revision. Regarding need for revision, no statistically significant differences were found concerning age, sex, cleft type, syndrome, or time between palatoplasty and SP (\( P > .05 \), t test).

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Ysunza and Pamplona\(^23\) used electromyography after SP and determined that there was no intrinsic muscle activity in the palatopharyngeus, but there was normal activity of the superior constrictor muscle. Augmentation of the posterior nasopharynx was the benefit, they concluded, rather than active contraction of the sphincter. Since Riski et al\(^16\) popularized the importance of a high posterior nasopharyngeal insertion point, other retrospective studies\(^10,11,24\) reported revision rates similar to ours (13%), with a narrow range of 11.5% to 16%. Of the 6 revisions performed in our study, 2 were indicated for persistent hypernasality alone and 2 for documented inferior flap placement. Notably, the 2 with documented low flap placement were performed in the first 2 years of this review, which indicates the importance of widely distributing the knowledge of high flap placement. Since that time, we routinely place the myomucosal flaps as high in the nasopharynx as is feasibly possible, which may mean resecting a portion of adenoid tissue. This process may contribute to the comparable success rate (87%). Consistent prognostic predictors for the failure of primary SP have not been identified in this study, which corroborates findings in similar studies.\(^10,11\)

The success of surgical management of VPI is difficult to determine due to the subjective nature of perceptual speech assessments in postoperative follow-up. Therefore, ideal outcome measures are difficult to define. Complete resolution of VPI is not evident in all patients after primary VPI surgery; however, surgical revision is not undertaken unless it is thought that VP competence cannot yield “normal” speech after aggressive speech therapy (1-year duration). Accordingly, the aim of surgical management is to provide enough VP competence so that resolution of VPI is achievable by speech therapy. Thus, the diagnosis of persistent VPI (by perceptual speech assessment and nasendoscopy) after speech therapy, and, therefore, probable need for surgical revision, implicates revision rate as an important outcome measure. This addresses a potential limitation in this retrospective study. The subjective nature of speech assessment certainly helped define the need for surgical revision and also the success of the surgical intervention. Owing to incomplete records and changes in medical documentation, it was impossible to review speech samples. Ideally, speech samples would have been reviewed independently by other speech pathologists. This would have improved the reliability of subjective speech evaluations in this retrospective study. Future prospective studies would address this issue.

Herein, we report significantly improved outcomes of SP in patients who had previous (n = 5) or concomitant (n = 21) FP vs those who had SP alone (n = 20). Recent literature\(^19,20\) has suggested increased efficacy of concomitant SP and FP for the surgical management of VPI. Cheng et al\(^18\) describe a modified procedure for the treatment of primary cleft palate repair and secondary VPI. The procedure combines a tunneled palatopharyngeus myomucosal flap behind a bridge of superior constrictor and a double-opposing FP. In describing the Seattle protocol, Sie and Chen\(^20\) consider the use of concomitant SP and FP for patients with VPI and a large gap on nasendoscopy (<50% closure), especially for those with a notch or groove of the soft palate on the nasendoscopic view. Theoretically, the combined procedure addresses all contributing factors and creates a more physiologic velopharynx, which alone, both SP and intravelar palatoplasty (FP) cannot achieve. These factors include repair of velar musculature, improvement in the lateral pharynx, reduction of an enlarged nasopharynx, and lengthening of a shortened soft palate. Given that SP or FP alone neglects the important velar element, no single procedure is suitable for all deformities. Further studies are needed and are underway to illuminate the role of concomitant SP and FP in the surgical management of VPI.\(^20\)

In conclusion, SP is an effective procedure for the management of VPI, and the present outcomes compare favorably with similar studies. Prognostic factors for surgical revision are difficult to identify in retrospective studies. Furthermore, this study suggests that concomitant FP and SP may improve outcomes compared with
SP alone, which may be related to creating a more physiologic velopharynx.

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Correspondence: Virender K. Singhal, MD, Department of Plastic Surgery/Craniofacial/Cleft Palate, Children’s Mercy Hospital, 2401 Gillham Rd, Kansas City, MO 64108 (vsinghal@cmh.edu).

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REFERENCES