

Evaluation and Management of Velopharyngeal Incompetence

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A B S T R A C T

Introduction: Palatoplasty for cleft lip and palate is associated with two major complications speech development disorders, including velopharyngeal insufficiency, and maxillary growth disturbance. Current study aimed to assess velopharyngeal incompetence and anatomical factors contributing to incomplete closure following cleft palate repair and to evaluate the patients after the surgical procedure and attempted to recommend an appropriate management strategy.

Materials and Methods: A prospective observational study was conducted from January 2011 to January-2013. A total of 28 patients with operated cleft palate having clinical features of velopharyngeal insufficiency were included in the study. Patients were evaluated by history, physical examination, Video fluoroscopy, Nasoendoscopy. Velopharyngeal gap size and closure pattern were taken into account based on the endoscopy report. Velopharyngeal gap size was rated on a four-point scale.

Results: Among our study participants, 9 (32%) were aged between 11 to 15 years, and 16 (57%) were males. Out of 28 cases with velopharyngeal incompetence, who were assessed endoscopically, the distribution of closure pattern was circular in 20(72%) cases. There were no patients found with sagittal closure pattern.

Conclusion: Our study concluded that Surgical correction of VPI improves speech and patients are advised speech therapy to improve the compensatory articulations.

Keywords: Velopharyngeal Incompetence, Cleft Palate Surgery, Hyderabad

INTRODUCTION

The soft palate (velum) is a fibromuscular shelf made up of five muscles attached as a sling to the posterior portion of the hard palate. It functions to elevate the nasopharynx, effectively closing the communication from the nasopharynx to the oropharynx.¹

The velopharynx is a complex structure that is responsible for the separation of the oral and nasal cavities during speech production and swallowing.² Velopharyngeal closure refers to the normal opposition of the soft palate, or velum, with the posterior and lateral pharyngeal walls. It is primarily a sphincteric mechanism consisting of a velar component and a pharyngeal component. Movement of the velar component is produced principally by the action of the levator veli palatini muscle. The functional goals of cleft palate surgery are to facilitate normal speech and hearing without interfering with the facial growth of a child.³

Velopharyngeal dysfunction (VPD) refers to any situation in which an individual is unable to completely close the nasal airway during a speech. VPD can manifest as hypernasality, nasal emission, decreased vocal intensity, and/or facial

grimacing. Moreover, patients who suffer from VPD will frequently develop maladaptive articulations to compensate for their speech difficulties.

VPI has been differentially interpreted as denoting insufficiency, incompetence, and inadequacy - terms that may be similar, but are not synonymous and potentially implicate the cause of the dysfunction rather than describe the clinical finding. VPD is seen in roughly 20 to 30% of individuals who have undergone cleft palate repair, and 5 to 10% of patients with a submucous cleft palate (SMCP).

Cleft palate represents the third most frequently occurring congenital deformity after clubfoot and cleft lip. If the cleft palate is left untreated, it may lead to velopharyngeal insufficiency (VPI) and speech distortion as the child grows.⁴ Some neuromuscular aetiologies can also result in VPD and are occasionally referred to as *velopharyngeal incompetence*. Childhood apraxia of speech is a motor speech disorder that hinders appropriate coordination of muscle movements for appropriate function. Hypernasality increases with connected speech and is associated with inconsistent articulation errors. Neurologic impairment, congenital abnormalities, or traumatic/iatrogenic injury are among some of the other

myoneuronal etiologies that can render the velopharyngeal apparatus "incompetent," leading to VPD.⁵ VPI caused by cleft palate is amenable for surgical intervention.

The functional goals of cleft palate surgery are normal speech, hearing, and maxillofacial growth. It is generally thought that speech and hearing are improved by early cleft palate repair (before 24 months of age) and that delayed closure (after 4 years) is associated with less retardation of midfacial growth. The primary goal in the timing of cleft palate surgery, therefore, is to provide the adequate palatal function for the development of normal speech without interfering significantly with maxillofacial growth.⁶

The present study was conducted to assess velopharyngeal incompetence and anatomical factors contributing to incomplete closure following cleft palate repair. We have also evaluated the patients after the surgical procedure and attempted to recommend an appropriate management strategy.

MATERIAL AND METHODS

The current study was a prospective observational study done in was Department of Plastic Surgery, Osmania General Hospital, Hyderabad, which included operated cleft palate patients having clinical features of velopharyngeal insufficiency.

Study duration: The data collection for the study was

Age (Years)	Number (%)
5-10	6 (21%)
11-15	9 (32%)
16-20	8 (29%)
21-25	5 (18%)
Sex distribution	
Male	16 (57%)
Female	12 (43%)

Table-1: Age and gender distribution of VPI cases (N=28)

Type of cleft	No of cases
Unilateral Cleft lip and palate	14 (50%)
Bilateral Cleft lip and palate	8 (29%)
Isolated Cleft palate	6 (21%)

Table-2: Type of cleft associated with velopharyngeal incompetence

Parameter	Number (%)	Choice of Procedure
Gap Size		
Small Gap(3-5mm)	5 (17.8%)	Furlow's Palatoplasty
Medium Gap(6-10mm)	13 (46.4%)	Furlow's Palatoplasty Buccal My mucosal Flaps
Large Gap(>10mm)	10 (35.8%)	Pharyngeal Flaps Buccal My mucosal Flaps
Closure Pattern		
Circular	20 (71.42%)	Pharyngeal Flaps Buccal My mucosal flaps
Coronal	8 (28.58%)	Furlow's Palatoplasty Buccal My mucosal Flaps

Table-3: Relation Between Gap Size, Closure Pattern and Choice of Procedure

conducted from January 2011 to January-2013.

Ethical approval: The study was approved by the Institutional Human Ethical Committee and informed written consent was obtained from all the participants.

Procedure: Patients were evaluated by history, physical examination, Video fluoroscopy, Nasoendoscopy. Nasoendoscopic examination was done in the department of ENT, Govt ENT Hospital, Koti. Velopharyngeal gap size and closure pattern were taken into account based on the endoscopy report.

Velopharyngeal gap size was rated on a four-point scale. Closure pattern was considered in 3 parts that included sagittal, coronal, and circular. We recorded the speech sample for 20 seconds each (lateral and Townes view); an average of the standard maximum measurements was obtained and velopharyngeal function was reported. The follow-up period ranged from eighteen months to three months. Patients were evaluated during the follow up period for improvement of symptoms and video fluoroscopy and nasoendoscopy and compared with the preop values.

STATISTICAL ANALYSIS

Data was presented as mean and standard deviation for quantitative variables, frequency and proportion of categorical variables. IBM SPSS version 21 was used for data analysis.

RESULTS

Among the study population, 6(21%) participants were aged between 5 to 10 years, 9 (32%) were aged between 11 to 15 years, 8 (29%) were aged between 16 to 20years, 5 (18%) were aged between 21 to 25years. 16 (57%) were participants male

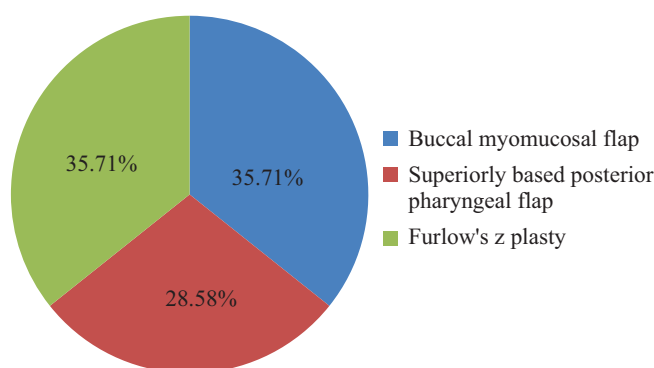


Figure-1: Types of Procedures done for Correction of VPI

and remaining 12 (43%) participants were female. (Table 1) Out of these 28 cases of VPI 14(50%) were unilateral cleft lip and palate, 8(29%) were cases of bilateral Cleft lip and palate and remaining 6(21%) were isolated cleft palate. (Table 2)

Among all other procedures 10 (35.71%), patients underwent Furlow's z plasty for correction of VPI, another 10 (35.71%) underwent buccal mucosal flap, remaining 8 (28.58%) underwent superiorly based posterior pharyngeal flap. (Figure 1)

In our study, out of 28 cases with velopharyngeal incompetence, who were assessed endoscopically, the distribution of closure pattern was circular in 20(72%) cases and coronal 8 (28%), whereas there was no patient having closure pattern of sagittal. (Table 3)

DISCUSSION

The present study was undertaken to evaluate the velopharyngeal incompetence in patients who were already operated for cleft palate earlier and having symptoms of the nasal twang of voice and history of nasal regurgitation. The patients were evaluated by pre-operative nasoendoscopy and video fluoroscopy and pre-operative VPI gap size and closure pattern were taken into account in planning the appropriate procedure. The patients were followed for a period ranging from eighteen months to three months and evaluated in the postoperative period for the improvement of symptoms any complications of the surgery and post op VPI gap size and closure pattern.

A study was conducted to utilize three-dimensional magnetic resonance imaging (MRI) to correlate velopharyngeal closure patterns with velopharyngeal anatomical structural characteristics. Velar length and adenoid thickness varied based on closure patterns, with coronal closure pattern demonstrating significantly larger values compared to circular closure pattern. There were no statistically significant differences for effective velar length, pharyngeal depth, nasopharyngeal length, posterior pharyngeal wall thickness, and nasopharyngeal width based on the type of closure pattern. Closure patterns varied by gender, with females demonstrating more circular closure patterns compared to males who demonstrated more coronal closure patterns. Statistically significant differences were observed in velopharyngeal anatomical structural measures and gender during evaluations of closure patterns. These preliminary findings indicate the length of the velum and thickness of the adenoids may have the greatest impact on velopharyngeal closure patterns.⁷ In our study, out of 28 cases with velopharyngeal incompetence, who were assessed endoscopically, the distribution of closure pattern was circular in 20 (72%) cases and coronal 8 (28%), whereas there was no patient having closure pattern of sagittal. Another study showed that Selection of the surgical procedure depending on the type of preoperative VPC pattern for the treatment of post palatoplasty VPI is an appropriate method. In case of a circular closure pattern, sphincter pharyngoplasty is the operation of choice as it has a lower incidence of postoperative snoring than pharyngeal flap.⁸ In a study of 148 consecutive patients, the conclusion was preoperative velopharyngeal gap

size, as determined with nasoendoscopy, was significantly associated with postoperative velopharyngeal insufficiency severity after Furlow palatoplasty. Small gap size was associated with a greater likelihood of resolution.⁹

In another study author concluded that closure patterns vary based on gender, with females demonstrating a circular closure pattern compared to males who demonstrate more of a coronal closure pattern. Velopharyngeal measures and gender revealed statistically significant differences when investigating closure patterns.¹⁰

In our study, out of the 10 patients treated with Furlow's double opposing z plasty. No complications were noted in any of the patients. All patients had satisfactory improvement of the nasal twang of voice and symptoms of nasal regurgitation had subsided. Complete closure was attained in 7 patients with preop VPI gapless than 5mm, but the closure was incomplete in 3 cases where the pre-op VPI gap was more than 5mm with residual VPI gap of 2mm.

A retrospective study undertaken to assess speech outcomes in patients undergoing Furlow palatoplasty concluded that patients had a complete resolution or substantial improvement of velopharyngeal insufficiency postoperatively, and there were few surgical complications.¹¹ In a retrospective study it was seen that participants who had had Furlow repairs were superior on measures of hypernasality, articulation, and total speech scores; and fewer pharyngeal flaps were required by Furlow subjects.¹²

A survey identified normal patient speech as the criterion of success after correctional surgery for VPI. Assessment and management of VPI in Great Britain and Ireland is a highly varied practice. When a palatal procedure is indicated, surgical approaches are tailored to address each individual's pattern of velopharyngeal closure deficiency. The surgeons surveyed reported this as being most accurately demonstrated by direct nasoendoscopic visualisation and dynamic multi-planar video fluoroscopic studies.¹³

A research stated that although the lavatory muscle sling might be disturbed by the redo DOZ procedure, the surgery was effective in correcting the residual VPI with low morbidity.¹⁴

In a study, Significant improvement of APA and nasalalance score for oral and nasal sentences was achieved. Flexible nasopharyngoscopy showed complete velopharyngeal closure in 19 patients (82%) postoperatively. Which stated Furlow palatoplasty is considered a useful treatment option for VPI in patients with previously repaired cleft palate, it improves the speech and velopharyngeal closure.¹⁵

In another research conclusion obtained was Double-opposing Z-palatoplasty is a surgical technique that could be used successfully to correct velopharyngeal incompetence in selected secondary palatoplasty patients. This technique permits correction of velopharyngeal incompetence and restoration of the velopharyngeal mechanism irrespective of prior intravelarveloplasty and without accompanying loss in the nasal airway. Preoperative assessment can better identify those patients who are less likely to achieve velopharyngeal competence following double-opposing Z-palatoplasty alone.¹⁶

In our study out of the 8 patients treated with Superiorly based

posterior pharyngeal flap, all patients have complained throat pain and difficulty in swallowing the immediate post-operative period, which was relieved with continued oral intake. In n research results showed that superiorly based pharyngeal flap is highly successful in correcting VPI after Le Fort I maxillary advancement in patients with repaired CL/P.¹⁷ On late follow up, all patients had satisfactory improvement of the nasal twang of voice and the symptoms of nasal regurgitation had subsided. Among them 4 patients complained of snoring and halitosis. A retrospective chart review was conducted for 84 consecutive nonsyndromic postpalatoplasty patients undergoing velopharyngeal insufficiency pharyngeal flap group showed postoperative snoring, and one (2.6 per cent) of them presented with obstructive sleep apnea.¹⁸ Snoring was because of narrowing of the effective velopharyngeal orifice and halitosis because of pooled up oral secretion over the flap. None of the patients had symptoms of obstructive sleep apnoea. In one study the significant number of middle-aged adults with repaired cleft palate had OSA and related symptoms, regardless of the presence of a pharyngeal flap. Results suggest that VPI treatment with a flap may not cause sleep-disordered breathing in the cleft population. Besides advancing age, congenital upper airway abnormalities may be involved. Flap was viable in all the patients. 6 patients had VPI gap reduced from large preoperative gap to almost nil lateral port gaps and 2 patients had small lateral port gaps while assessing the velopharyngeal closure post operatively.

Conclusion

In our research we concluded that Nasoendoscopy and video fluoroscopy could give an excellent assessment of velopharyngeal closure. Surgical correction of VPI corrects the symptoms of nasal regurgitation, reduces the respiratory problems and improves oral hygiene. Surgical correction of VPI improves speech and patients are advised speech therapy to improve the compensatory articulations.

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