Management of velopharyngeal insufficiency by augmentation of posterior pharyngeal wall with bone graft

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ABSTRACT

Objectives: This study is aiming at evaluation of the surgical treatment of velopharyngeal insufficiency (VPI) by augmentation of the posterior pharyngeal wall by bone grafts to aid the proper closure of the velopharyngeal sphincter on backwards movement of the soft palate during speech and swallowing, with the preservation of a patent airway.

Methodology: Eight patients with VPI due to different causes (mainly repaired cleft palate and paralytic conditions of the soft palate) were evaluated by approximate measurements of the gap left opened in the velopharyngeal sphincter during phonation and swallowing.

They all underwent surgery of augmentation of the posterior pharyngeal wall by bone grafts from the iliac crest to close the gap left in the velopharyngeal sphincter while functioning. Follow up and post-operative evaluation periods extended from 4-8 years.

Results: The results obtained by this surgical procedure were encouraging where 87.5% of the patients suffering from nasal escape in speech or hepernasality had a good to complete improvement; only one patient had a poor improvement. In the 6 patients with regurgitation of fluids during swallowing, 5 of them (81.5%) had got a complete improvement. All the patients suffering from regurgitation of solid food (4 patients) got fully improved. All the patients post-operatively remained breathing satisfactorily, no post-operative snoring, nor any upper airway breathing difficulties.

Conclusions: This surgical procedure is recommended as one of the first line treatment of VPI for its simplicity as no restrictions to be put that the surgery should be performed by highly skilled hands only, the easy way of estimation of the condition, and almost no morbidity and no danger to affect the airway, on the other hand it is not highly recommended in the larger gaps of the velopharyngeal sphincter as the results were not as encouraging as in the smaller and medium gaps.

Key words: Velopharyngeal insufficiency, Velopharyngeal incompetence, Rhinolalia aperta.

Introduction

Velopharyngeal insufficiency (VPI) or incompetence is the incomplete closure of the sphincter between the nasopharynx and the oropharynx by the backwards movement of the soft palate during speech and swallowing causing nasal escape i.e. hypernasality or rhinolalia aperta in the first and nasal regurgitation of fluids and food in the latter.

Causes include the cleft palate although this is becoming an extremely rare condition now for almost all the cases are being repaired before the age of 2 years, yet more than 20% of the cases with repaired cleft palates are still having the VPI [1].

In the cases of submucous and occult cleft palate the defect may cause speech problems that might not be explained easily, anyhow most of those patients would benefit from speech therapy and only 3% may need more invasive interference as velopharyngoplasty[2].

Neuromuscular dysfunction of the soft palate is a difficult condition for treatment where the anatomy is normal but movement is impaired as in Guillain-Barre` syndrome, pseudobulbar palsy, meningitis [3].

VPI can occur after surgery to the soft palate and pharynx as in treatment of palatal tumors, procedures to snoring and sleep apnea; it can occur after adenoidectomy if an occult cleft is passed unnoticed[4].

Another cause is the congenital VPI resulting from the congenital disproportion between the soft palate and the nasopharynx [1,5]

Many modalities of treatment of VPI have been described starting from the conservative ones of speech therapy, the use of obturators [6], cleft palate repair with implants[7], besides the velopharyngoplasty and augmentation of the pharyngeal wall, the decision of line of treatment would depend on the differential diagnosis and evaluation of the condition[8].

The degree of VPI i.e. the gap left during phonation and swallowing is a very important factor in the results obtained by any type of correction [9].

Patients & methods

The study included 8 patients with different causes of VPI, their ages ranged from 14- 27 years (mean of 18.8 years), all complaining of speech impairment, 6 of them complained of nasal regurgitation to fluids, and only 4 complained of food regurgitation.

The evaluation of each was done by simple oral examination for the clinical assessment of movement of the soft palate and it was put in three categories; good, limited, and poor. Nasoendoscopy and radiological examination of the postnasal space and

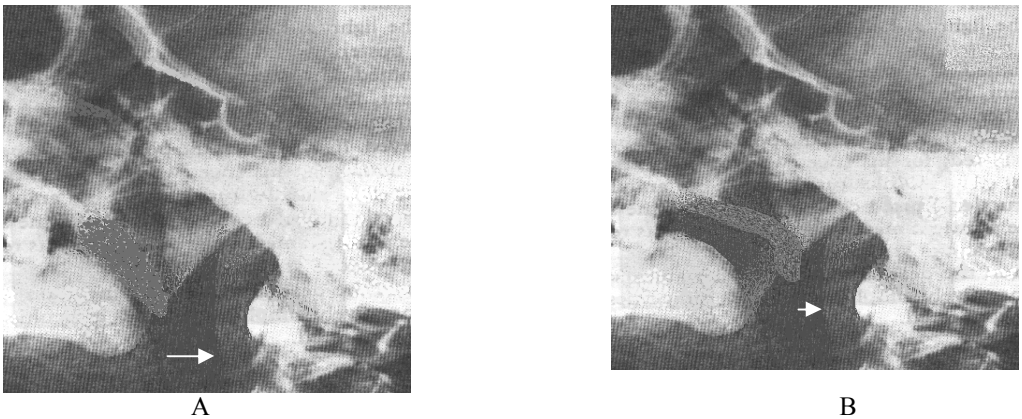
soft palate in the lateral view during phonation was done to asses the defect or gap in the velopharyngeal sphincter and measured approximately in (mm).

Tympanometry was done to 2 of the patients, they were complaining of hearing loss besides the other symptoms.

All the patients were treated surgically by augmentation of the posterior pharyngeal wall with a bone graft taken from the iliac crest, sculptured to suit the size of the estimated gap or defect in the velopharyngeal sphincter and placed on the anterior surface of the body of the first cervical vertebra to increase the size of the passavant ridge to make it easier for the soft palate to close the velopharyngeal sphincter on moving backwards during phonation and swallowing.

Post-operative assessment and follow up periods extended between
4- 8 years, the results of surgery were evaluated in the same ways as the pre-operative evaluation of the velopharyngeal sphincter function by the nasoendoscopic and radiological examination of the soft palate and its movement in relation to the posterior pharyngeal wall in the static positions and during phonation and swallowing to look for the improvement in speech, nasal escape, regurgitation of fluids and food, and if the way of treatment has caused any change in breathing patterns.

Figures (1) and (2) show the X-ray lateral image of the soft tissue of velopharyngeal sphincter pre, and post-operatively and the site of the bone graft to augment the posterior pharyngeal wall.



A B

Figure-1: Lateral X-rays of the postnasal space, showing the soft palate In static position (A), and during phonation (B). Notice the gap left between The soft palate and the posterior pharyngeal wall (arrows).

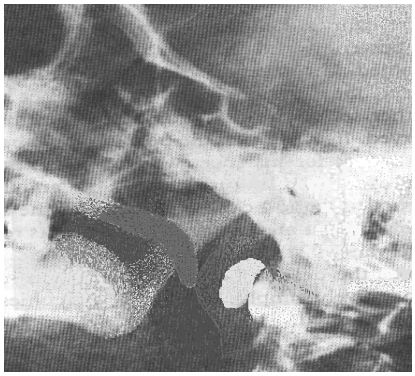


Figure-2: Post-operative X-ray, notice the bone graft and how the soft palate is meeting the posterior wall in phonation.

Results:

The eight patients involved in this study were in the age range of 14- 27 years with a mean of 18.8 years, their gender was 5 males to 3 females i.e. the ♂:♀ ratio was 1.66: 1.

The 8 patients were presented with VPI due to different causes, the cases with previously repaired cleft palate being the majority, 4 patients (50%), three patients with paralysis of soft palate (37.5%), and one patient had a congenital palato-pharyngeal disproportion (12.5%).(Table-1).

Table (1) shows the patients age, gender, the different causes of VPI, and the degree of movement of soft palate:

Patients	Age & gender	Causes of VPI	Movement of SP
1	19 ♂	Bulbar palsy	Limited
2	20 ♂	Cleft palate repair	Limited
3	27 ♀	Unknown, paralysis	Poor
4	15 ♀	Cleft palate repair	Limited
5	22 ♂	Cleft palate repair	Good
6	18 ♂	Meningitis, paralysis	Limited
7	16 ♀	Congenital disproportion	Good
8	14 ♂	Cleft palate repair	Limited

The Approximate measures of the defect in closure of the velopharyngeal sphincter by the nasoendoscope and lateral X-rays of the postnasal space is shown in table (2):

Table- 2: shows the Approximate measures defect in closure of the velopharyngeal sphincter by the nasoendoscope and lateral X-rays of the postnasal space

Patients	Gap (in mm.)
1	8 mm
2	5 mm
3	3 mm
4	6 mm
5	3 mm
6	5 mm
7	4 mm
8	4 mm

The main complaint of the patients was the speech impairment in the form of hypernasality (rhinolalia aperta); one of them had hoarseness besides. Six of the patients had nasal regurgitation to fluid and four of them had regurgitation to solid food also. Only two of the patients had hearing problems found to be of conductive type due to Eustachian tube dysfunction, they both had had their cleft palate repaired earlier. The patients complaints and symptoms are shown in table (3):

Table- 3: shows the patients complaints and symptoms

No. of patients	Speech impairment		Nasal regurgitation		Ear symptoms
	hypernasality	hoarseness	to fluids	to solids	
1	+ve	+ve	+ve	+ve	-ve
2	+ve	-ve	+ve	-ve	+ve
3	+ve	-ve	-ve	-ve	-ve
4	+ve	-ve	+ve	+ve	+ve
5	+ve	-ve	-ve	-ve	-ve
6	+ve	-ve	+ve	+ve	-ve
7	+ve	-ve	+ve	+ve	-ve
8	+ve	-ve	+ve	-ve	-ve
	100%	**12.5%**	**75%**	**50%**	**25%**

After the correction of the VPI by bone graft augmentation of the posterior pharyngeal wall and during the periods of follow up 7 of the patients showed good to complete improvement in speech (87.5%), only one had a poor speech improvement (12.5%), that patient had the largest velopharyngeal gap (8 mm), paralytic soft palate, and hoarseness due to vocal cords weakness, as shown in table (4):

Table- 4 shows the result After correction by bone graft augmentation of the posterior pharyngeal wall

No. of patients	Improvement in hypernasality
1	Poor
2	Complete
3	Complete
4	Good
5	Complete
6	Complete
7	Complete
8	Complete

The improvement in nasal regurgitation was very satisfactory (81.5% to fluids and 100% to solids) only one patient is still having regurgitation to fluid but not to solid food; once again this is the patient with the largest velopharyngeal gap. The rest of the patients were completely improved as shown in table (5):

Table- 5 shows the result after correction by bove graft augmentation of posterior pharyngeal wall

No. of patients	Improvement in regurgitation	
	to fluids	to solids
1	Poor	Good
2	Complete	------
3	------	------
4	Complete	Complete
5	------	------
6	Complete	Complete
7	Complete	Complete
8	Complete	------
	81.5%	**100%**

The two patients with conductive hearing loss were treated by myringotomy with insertion of ventilation tubes in the same session of surgery, they retained normal hearing immediately.

All the patients were breathing satisfactorily after surgery, none complained of snoring, sleep apnea, or any other breathing problems.

Discussion

The old say "Do not solve a problem on the expense of another" is very much applicable here because the surgical treatment of VPI is based in general on the reduction of the gap left in velopharyngeal sphincter during phonation and swallowing hence jeopardizing the airway, so any kind of surgery should consider the airway patency in contrast to the closure of velopharyngeal gap leading to nasal escape, besides the morbidity of the procedure.

Different studies on the condition emphasized many ideas of authors about the causes of VPI and modalities of treatment; Pinto et al. (2003) have chosen the conservative way of treatment by application of obturators to close the defect in hard and soft palate with good results, but yet it showed to be annoying to patients to have a prosthesis to put on and off when needed while speaking or eating [6].

The pharyngoplasty, fashioning a posterior flap with palatal pushback has been described by Shprintzen et al. (1989), where a complete velopharyngeal closure is performed by the flap leaving the lateral gaps to be closed during function by the lateral pharyngeal walls moving medially and meet the flap, the success rate was variable (30- 100%), besides, this procedure carried a high morbidity to airway [10].

The procedure of augmentation of the posterior pharyngeal wall by the bone graft from the iliac crest in comparison to the other surgical procedures showed almost no morbidity because of its simplicity as a 30 minutes procedure, less invasive, aiming at decreasing the gap and make it easier for the soft palate to approach the posterior pharyngeal wall during function, at the same time preserving the near normal shape and function of the velopharyngeal sphincter, besides no synthetic foreign materials were used since the graft was an autograft from the iliac crest.

Observing the end results with a fair enough periods of follow up, they look satisfactory in general, and specifically excellent in the cases with small and medium sized defect of the velopharyngeal sphincter, while the larger gap of about 8 mm showed less improvement or no improvement in some aspects as nasal escape in speech and regurgitation to fluids, that patient

had a central paralysis affecting the muscles of pharynx and larynx leading to hoarseness besides the hypernasality and regurgitation, and such cases were also reluctant to treatment by the other surgical procedures, moreover, Lewy et al. (1965) have stated that a defect of 4 mm or larger is difficult to be treated by posterior wall augmentation with Teflon injection and smaller gaps have shown better success [11].

The airway of the patients post-operatively was good and not affected by the procedure, as the aim of this modality of treatment was aiding the function during movement and not on static basis; so all the patients were breathing satisfactorily on day and night times and none complained of any snoring or any degree of sleep apnea.

Conclusions:

1. The easy way of estimation of the VPI and detection of the gap in the sphincter by the flexible fiberoptic nasoscope makes it a preferable tool in diagnosis and planning of treatment.
2. The procedure is very simple and needs no highly skilled hands to be performed; besides, it is less invasive than most of the other surgical procedures as we have seen earlier.
3. The use of autografts from the iliac crest and avoidance of synthetic materials and implants as Teflon and sialastics has lessened the complications and problems of rejection.
4. Besides the simplicity and no complications during treatment and follow up periods, the procedure has resulted in very satisfactory improvements in hypernasality and nasal regurgitation.
5. The preservation of the airway patency with the achievement of normal or near normal function of the velopharyngeal sphincter makes this procedure good enough to be recommended as one of the first line treatment.
6. Larger defects in velopharyngeal sphincter showed less response to this type of surgery unlike the medium and smaller ones of 6 mm and less, so larger defects around 8 mm are not absolutely recommended for this type of surgery; since these large defects showed less encouraging results in the other types of surgery also, they may be better treated by conservative measures like the closure by obturators.

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