A Prospective and Randomized Series Comparing Superiorly and Inferiorly Based Posterior Pharyngeal Flaps*

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Introduction

Since secondary correction of velopharyngeal incompetence was first introduced by Passavant in 1865 numerous techniques have been described to aid in achieving competence. Superiorly and inferiorly based posterior pharyngeal flaps are widely used and are the secondary procedure nearly always used at Children's Hospital of Philadelphia for correction of velopharyngeal incompetence.

There are proponents for both superiorly and inferiorly based flaps. Most investigators however have found no significant difference in the clinical result achieved by the two types of flaps, (*2, 6, 11*) but often with only tentative conclusions (*11*). The prospective, randomized series of patients and procedures described in this paper was undertaken to compare the two types of flaps.

STUDY STRUCTURE. Between August 1966 and July 1971, 35 patients met the criteria for inclusion into the study.

The presence of velopharyngeal incompetence and the need for a posterior pharyngeal flap were established by procedures commonly used for that purpose. The use of cinefluorographic studies and lateral static X-rays confirmed the diagnosis in 30 patients. Of the remaining five, three did not have X-rays because of severe, clinically clear velopharyngeal incompetence. For reasons described elsewhere from our unit (*1*) the physical and speech examination is our final criterion for proceeding with a posterior pharyngeal flap. The 2 patients without X-ray confirmation but with clinical velopharyngeal incompetence were therefore included in the study and operated upon. Pressure studies and sound spectrographs were done frequently but not routinely.

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* Similar to the recommendation of the Committee for Simplified Classification of Speech of the American Cleft Palate Association.

During the 5 year period a total of 142 posterior pharyngeal flaps were done. Thirty-five had no gross evidence of other mental or physical defects impairing speech and the anatomic possibility of equal choice between a superiorly and inferiorly based flap. Seventeen had superiorly based and eighteen inferiorly based flaps, and comprise the study group. The final determination of equal choice between the two types of flaps was done under general endotracheal anesthesia at the time of surgery. If the patient qualified anatomically standard, parallel lateral posterior pharyngeal incisions were made and the flap elevated as a bipedicle structure. Without the option of extending the incisions further, the decision for a superiorly or inferiorly based flap was made at that point, using a lottery system. The pedicle was then cut across superiorly or inferiorly depending on whether an inferiorly or superiorly based flap was to be done. Superiorly based posterior pharyngeal flaps were placed high on the nasal side of the soft palate. Inferiorly based flaps were inserted on the oral side well up into the muscular part of the palate. A turnover flap of palatal mucosa based posteriorly was used to line the raw side. The donor site in the pharynx was closed primarily. In no case was any other surgical procedure carried out.

Evaluations were done throughout the immediate post operative period, then at three weeks, and subsequently at six monthly and yearly intervals in the Cleft Palate Clinic. Pertinent observations were recorded on standard assessment sheets by each of the involved specialties including plastic surgery, speech and audiology, otolaryngology, and pediatrics. These are the observations utilized in the comparison. Speech categorization assigned is for purposes of simplicity and classification, only that feature which seemed most dominant in the patient's speech.

Factors Compared and Results. None included in the study had gross evidence of mental deficiency at the time of inclusion, though five were thought subsequently to be "slow learners" in school and one was in a "special school". The remainder were doing "average" or better work in school. I.Q. testing was not done. The group of "slow learners" included two with superiorly based and three with inferiorly based flaps. Four of the five when last seen had "normal or near normal speech for age", including the one patient in a special school who had severe unintelligibility pre operatively, and minimal articulatory errors, only post operatively. The one patient in this group who had persistent velopharyngeal incompetence ("slight") had an inferiorly based flap.

Age at operation was four to sixteen years (Table 1). The majority were in the 6–12 year age group (23 patients), and only one, was older than 14 years. Speech result achieved in the older age group (13–16 years) was not significantly different from that of the other age groups. Only one of the seven in the older age group, a 13-year old with a superiorly based flap, had velopharyngeal incompetence postoperatively.

Sex differences were minimal (Table 2). The number of each type of

TABLE 1

age at operation	
years age	*# pts*
4–5	5
6–12	23
13–16	7
total	35

TABLE 2

sex and flap type			
	female	*male*	*total*
sup	8	9	17
inf	8	10	18
total	16	19	35

TABLE 3

cleft classification and type flap done					
	I	*II*	*III*	*IV*	*total*
sup	2	8	2	5	17
inf	2	8	7	1	18
total	4	16	9	6	35

TABLE 4

cleft classification of those with persistent VPI				
	I	*II*	*III*	*IV*
sup	0	1	0	1
inf	0	1	2	1

all were classified as "slight VPI"

flap done in each sex was similar, with three more males than females. In those with persistent velopharyngeal incompetence postoperatively there were 3 males and 3 females.

Cleft severity, utilizing the Veau classification for simplicity, compared with type of flap done, is indicated in Table 3. In the less severe clefts (Classes I & II) the study groups are identical pre and postoperatively. In the more severe clefts (Classes III & IV) involving the entire palatal and pre palatal structures, the total number of patients is similar for the two types of flaps done (7 and 8). Of those with persistent velopharyngeal incompetence (Table 4), four of the six had the more severe clefts (Classes III & IV), three of the four having had inferiorly based flaps.

Preoperatively and postoperatively the patient's speech was classified by speech pathologists into one of four categories according to the classification indicated in Table 5.* To simplify subsequent discussion the terms normal (Group I), slight (Group II), moderate (Group III), and severe (Group IV) are used rather than the number designation.

Speech differences achieved with the two flap types were not statistically significant. Pre operative (Table 6) categorizations are indicated. The only two patients with severe velopharyngeal incompetence had superiorly based flaps.

* Similar to the recommendation of the Committee for a Simplified Classification of Speech of the American Cleft Palate Association.

TABLE 5. Speech classification.**

group I—normal speech for age (includes artic errors not due to cleft palate).
group II—mild or minimal speech distortion (noticeable if listened for) due to:
a. slight articulatory errors
b. slight hypernasality
c. slight hyponasality
d. slight nasal escape
group III—more severe distortions (obvious to casual listener).
a. moderate articulatory errors
b. moderate hypernasality
c. moderate hyponasality
d. moderate nasal escape
group IV—severe unintelligibility (less than 50% intelligible).
a. severe articulatory errors
b. severe hypernasality
c. severe hyponasality
d. severe nasal escape

** Speech classification as judged from word picture test, standard test sentences and relaxed conversational speech. If deviations from normal occur in more than one group the more severe group is used.

Postoperatively (Table 7) the shortest follow up time has been nine months. The number of those with speech disturbances is identical (8) with each of the two flap types. There were more patients with inferiorly based flaps who had velopharyngeal incompetence post operatively, and more with superiorly based flaps who had other speech disturbances. These differences are not statistically significant. Of those requiring secondary procedures 17% (6/35) have persistent velopharyngeal incompetence. One patient in the study group of 35 had speech distortion characterized as moderate in severity postoperatively. The remainder (34/35) were considered to have normal speech or speech with "slight" distortions.

Of those with persistent postoperative velopharyngeal incompetence, none were categorized as "severe" preoperatively. Two, both with inferiorly based flaps, had moderate velopharyngeal incompetence pre operatively (Table 8). All six of those with incompetence postoperatively had their incompetence classified as "slight".

Preoperative categorization of those with other speech abnormalities

TABLE 6. Speech classification—preoperative.

op done	*slight VPI*	*moderate VPI*	*severe VPI*	*total*
sup based	9	6	2	17
inf based	10	8	0	18

TABLE 7. Speech classification—postoperative.

	normal for age	*slight VPI*	*artic errors*		*slight hyponasality*	*total*
			slight	*mod*		
sup based	9	2	3	1	2	17
inf based	10	4	3	0	1	18
	—	–	–	–	–	—
total	19*	6	6	1**	3	35

* 57% (19/35) had "normal" speech following secondary correction.
** 97% (34/35) had "normal or near normal" after correction.

TABLE 8. Preoperative classification of those with persistent VPI postoperatively.

	slight VPI	*moderate VPI*	*total with VPI postop*
superiorly	2	0	2
inferiorly	2	2	4

TABLE 9. Preoperative classification of those with articulatory errors postoperatively.

	slight VPI	*moderative VPI*	*severe VPI*	*total with artic errors postop*
sup	2	1	1	4
inf	3	1	0	4

postoperatively again showed only slight differences between the two flaps (Tables 9 and 10).

Hearing assessment was complete in all but two patients (Table 11). Postoperatively the hearing loss was more than 20 dB in six patients with superiorly based posterior pharyngeal flaps compared to only two with inferiorly based flaps. This difference is not statistically significant.

There was only one noteworthy operative complication, hemorrhage requiring transfusion in a patient having a superiorly based flap done. Immediate postoperative complications (Table 12) were more frequent in those with inferiorly based flaps but none was severe enough to require another operation. In no case was hospitalization prolonged beyond 7 days. Most were discharged at five days and recently more frequently at three days postoperatively.

The only late complication (following discharge) of note was dehiscence

TABLE 10. Preoperative classification of those with hyponasality postoperatively.

	slight VPI	*moderate VPI*	*total with hyponasality postoperatively*
sup	1	1	2
inf	0	1	1

All three had hyponasality classified as "slight".

TABLE 11. Correlation of hearing* with type flap.

	<20 db. loss	*20–30 db. loss*	*30–40 db. loss*	*total*
sup	9	3	3	15
inf	14	2	0	16
	—	–	–	—
total	23	5	3	33**

* Most recent assessment in worst ear.
** Information not available on 2 patients.

TABLE 12. Complications, immediately postoperatively.*

	fever >38.5°C	*antibiotics for "infection"*	*airway problem*	*severe stiff neck*	*total*
sup	3	1	0	1	5
inf	5	2	1	2	10
	–	–	–	–	—
total	8	3	1	3	15

* After leaving recovery room, to discharge.

of an inferiorly based flap at about two weeks postoperatively. Snoring was a frequent complaint, but follow up was not accurate enough in our series to compare the two flap types with regard to this problem.

Discussion and Conclusions. The perception of nasal airflow is probably aided by cinefluorography and synchronized recordings of audio, intraoral, intranasal air pressure, and oral and nasal air flow studies (*9, 10*). Experience in unit, however, has shown extremely close correlation between the diagnosis obtained by these more sophisticated studies and that of the clinical examination (*1*). The physical and speech examinations have therefore been our final criteria in the diagnosis of velopharyngeal incompetence and the decision to proceed with surgery.

Following repair of a cleft palate 10–40% (*3, 11*) of patients will have velopharyngeal incompetence with about 30% having incompetence in most series. With the addition of a pharyngeal flap either at the time of cleft palate repair (*7*) or as a secondary procedure the incidence of velopharyngeal incompetence can be reduced significantly. Stark (*8*) has reported 83% with "normal" speech following combined palate and pharyngeal flap repair; Owsley, et. al. reported 86% with "socially acceptable" speech (*5*). In our experience, over 90% have palatal competence following palate repair alone or palate repair and a secondary procedure. 97% (34/35) have speech considered as normal or with "slight" distortions following such a secondary procedure.

There was near equal function with the two types of flaps when the patient was judged on the basis of postoperative speech, hearing, complications and length of hospital stay.

Other investigators have noted the importance of flap width (*3*), height of flap attachment (*5*), and movement of the lateral pharyngeal walls (*4*) in good speech function following pharyngeal flap. These factors were not assessed by us since all flaps were considered wide and attached high. Our findings of no sex difference at any point contrasted with that of Hamlen (*2*) who described better initial postoperative speech results in females. Intelligence and age have been shown to be of importance with respect to flap function (*2, 3*) but probably because of patient randomization in our series these items had no bearing on the final result.

In the usual case of velopharyngeal incompetence, therefore, anatomic variation or technical considerations dictating the need for one or the other type of flap would seem to be the only relevant factor in deciding between a superiorly or inferiorly based posterior pharyngeal flap.

Summary

Between August 1966 and July 1971, 35 patients with velopharyngeal incompetence had posterior pharyngeal flaps and have been evaluated in a prospective randomized study. 17% (6/35) still have velopharyngeal incompetence ("slight") but 97% (34/35) have speech considered as normal or with "slight" distortions following such a secondary procedure. There were no significant differences between superiorly and inferiorly based flaps in postoperative speech, hearing acuity, short and long term complications or length of hospital stay. Sex of the individual and extent of the cleft also did not affect the outcome. From this data it would appear that anatomic or technical considerations are therefore the only relevant factors in deciding on whether to do a superiorly or inferiorly based posterior pharyngeal flap for correction of velopharyngeal incompetence.

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