# Nasal Obstruction As a Complication of Pharyngeal Flap Surgery

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In a series of 85 patients who had *pharyngeal flap surgery* at Indiana University Medical Center, we found an unusually high incidence of *hyponasality* with total or near total *nasal obstruction*. The nasal obstruction was often occult, detected only after careful questioning and examination. Nasal obstruction was associated with *peri-operative infection* or *micrognathia* as in the Pierre Robin Anomalad. Flap division or port revision yielded a significant relief of the nasal obstruction and achievement of normal nasal balance.

## Introduction

The pharyngeal flap, since its introduction by Passavant (1862, 1878, 1979) has been used to treat a number of palatal deficiencies. Presently it is usually done for hypernasality related to cleft palate, submucous cleft palate, palatal fistulae, or a short or paralyzed palate. Except in palatopharyngeal insufficiency without cleft palate, the pharyngeal flap is usually used as a secondary operation to effect palatopharyngeal competence. The procedure has a high degree of success and a relatively low incidence of serious complications. Whitaker et al. (1972) reported slight residual velopharyngeal incompetence in 17% of 35 patients, but 97% had normal or only slightly distorted speech. Nylem and Wahlin (1977) reported hemorrhage to be the major complication, as have other authors. They also report that death, a rare complication, is usually the result of unrecognized (or uncorrected) bleeding or airway obstruction. Acute airway obstruction is common enough that some authors recommend placement of a tongue traction suture at the conclusion of the operative procedure (Graham et al., 1973). Walden (1957) even suggested using a tracheostomy for better control of the airway. Owsley and Blackfield (1965) have reported a 3% incidence of flap separation. No author considered infection a significant problem. Musgrave and Bremner (1960), however, imply that infection plays a role in dehiscence or faulty healing.

Chronic airway obstruction, with or without hyponasality, has been an infrequently reported complication. The hazards of pharyngeal flap surgery in children with Pierre Robin Anomalad or micrognathia are well known (Moll et al., 1963; Hoffman et al., 1965; Schulz et al., 1973; Jackson et al., 1977; Robson et al., 1977). Others have mentioned hyponasality in passing, stating that slightly hyponasal speech seemed to be an improvement over hypernasal speech. Moll et al. (1963) reported 12 cases of atresia or stenosis of the nasopharynx in 123 patients with pharyngeal flaps. They stated that some of them had been corrected and assumed that the remainder could also be surgically improved.

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They wrote:

> Considering the high percentage of success with this procedure (80 to 85 per cent) and the relatively low incidence of atresia or stenosis, it would not appear that the fear of producing mouth-breathers or individuals with denasal voices should not preclude the use of the pharyngeal flap technique on patients with velopharyngeal incompetence.

Bland et al. (1969) showed that chronic upper airway obstruction can result in pulmonary hypertension and congestive heart failure. Robson et al. (1977) reported a case of cor pulmonale resulting from a chronic partial airway obstruction after a simultaneous palatoplasty and pharyngeal flap. Conway et al., (1977) reported a case of hypersomnolence and intermittent upper airway obstruction in an adult with micrognathia. However, no author has mentioned the insidious nature of nasal obstruction, or cautioned that it might occur in the presence of acceptable speech.

TABLE 1. Symptoms and signs of chronic nasal obstruction

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| Sleep disturbances |
| Chronic daytime fatigue |
| Personality changes |
| depression |
| hostility |
| paranoia |
| Morning headaches |
| Hypersomnolence |
| Snoring |
| Nocturnal choking spells |
| Frequent awakenings |
| Decreased exercise tolerance |
| Shortness of breath with exertion |
| Mouth breathing |
| Decreased appetite |
| Growth arrest |
| Failure to thrive |
| Lessened olfaction |
| Difficulty eating and swallowing |
| Denasal Speech |
| Chronic nasal drainage |
| Frequent or persistent "colds" |
| Cor pulmonale |
| Systemic hypertension |
| Congestive heart failure |

## Methods

Clinical material for this study was comprised of 85 patients who underwent pharyngeal flap surgery during the five year period of 1972 to 1976 at the Indiana University Medical Center. All procedures were performed under general anesthesia by plastic surgery residents under the direct supervision of the staff of the Plastic Surgery Section. Most patients had had extensive pre-and postoperative workups by a multi-disciplinary team of plastic surgeons, otolaryngolotists, psychiatrists, radiologists, oral surgeons, speech pathologists, social workers, and/or visiting nurses. Many had had consultations by other departments in the teaching hospital, contributing to a complete profile of each patient.

For the purposes of this review, all patients were recalled for more extensive interviews and examinations. Each was questioned carefully about changes in eating habits, exercise tolerance, sleep patterns, olfaction, and respiration and was thoroughly examined (Table 1). If it was clinically appropriate, they were studied by nasopharyngograms and nasopharyngoscopy. The ability to inhale and exhale through each nostril was tested grossly by simple occlusion of the contralateral nostril. Nasal balance was evaluated independently by the surgeons and two speech pathologists. Speech tapes were made for each patient to further document speech status. This paper will deal only with nasal obstruction. A later paper will discuss speech results.

## Results

Of the 85 patients recalled, eight (10%) were identified as having significant nasal obstruction (Table 2). Many of these patients had been followed for several years after their pharyngeal flaps (range 1½ to seven years, mean three years) without the significance of their nasal obstruction being appreciated. Six of the eight patients had pharyngeal flaps because of persistent hypernasality after primary palatoplasty. For two patients, pharyngeal flap and palatoplasty constituted the primary procedure. One of these patients had velopharyngeal insufficiency secondary to a submucous cleft palate, and the other had a congenitally short palate.

Of these eight patients, five had infections associated with the pharyngeal flap procedure. Three had evidence of infection pre-

TABLE 2. Description of 8/85 patients who had nasal obstruction following pharyngeal flaps

| *Patient Birthdate* | 1° *Disease* | *Initial Surgery* | *n Result* | 2° *Surgery* | *Result* | *Tertiary Surgery* | *Result* |
|---|---|---|---|---|---|---|---|
| J. S./11-19-69 | Cleft lip and palate | 6/71-Palatoplasty | 12/77-Mild nasality | 1/76 Superiorly based unlined pharyngeal flap. Pharyngeal defect partially closed. Preoperatively left ear perforation and drainage with cervical adenopathy. Postoperative throat erythema with fever and leukocytosis. Penicillin and cephalothin given postoperatively. | 9/77 Denasal. Total nasal obstruction | 9/77 Take down of flap | 10/77 Normal nasal balance. Good airway. |
| S. H./5-18-63 | Short palate with hypernasality | 4/69-Palatoplasty with superiorly based lined pharyngeal flap. Pharyngeal defect closed. Postoperative leukocytosis and bleeding requiring transfusion. No antibiotic given. | 1/76-Denasal with nasal obstruction. Total occlusion left port. | 1/76 Port revision | 4/77 Normal nasal balance. Good airway. | | |
| J. H./1-19-67 | Complete cleft lip and palate | 6/68-Palatoplasty (hard palate) 1/73-Palatoplasty (soft palate) | Hypernasal | 11/75 Superiorly based unlined pharyngeal flap. Pharyngeal defect closed. Postoperative infection by Staph aureus and para influenza. Penicillin given postoperatively. | 11/76 Denasality, nasal obstruction | 3/77 Revision of ports | 5/77 Normal nasal balance. Good airway. |
| H. B./6-12-66 | Cleft lip and palate | 3/68-Vomer Flap 11/69-Palatoplasty | 6/71-Palatal fistula and hypernasality | 6/71 Superiorly based lined pharyngeal flap and redo Palatoplasty. Low grade fever | 7/75 Denasality, nasal obstruction | 7/75 Port enlargement | 5/78 Normal nasal balance. Good airway. |

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|---|---|---|---|---|---|---|---|
| | | | | pre and post operatively with leukocytosis and left shift. Penicillin given. | | | |
| N. B./1–57 | Cleft lip and palate | 7/68-Palatoplasty<br>10/69-Palatoplasty | Hypernasality | 8/72 Superiorly based lined pharyngeal flap. Pharyngeal defect left open. No antibiotics given, post operative fever elevated to 100° axillary for 4 days. | Denasality, nasal obstruction | 10/78 Take down of flap | 12/78 Normal nasal balance. Good airway. |
| M. T./10–13–70 | Submucous cleft palate with incomplete cleft lip, mild nasality | 1/76-Palatoplasty with superiorly based unlined pharyngeal flap. Intraoperative throat cultures of Staph aureus, resistant to penicillin. Post operative fever and leukocytosis. Penicillin given. | 8/77-Moderate nasality, nasal obstruction | 12/77 Take down of flap | 10/78 Normal nasal balance. Good airway. | | |
| J. M./10–3–70 | Cleft secondary palate Pierre Robin anomalad | 4/72-Palatoplasty. Respiratory distress postoperatively. | Soft palate fistula | 7/73 Repair of fistula. Postoperative respiratory arrest, requiring tracheotomy and chest tube. No antibiotics given. | Recurrence of fistula and nasality | 8/73 Superiorly based unlined pharyngeal flap. Pharyngeal defect closed. Respiratory arrest postoperatively. No antibiotics given. | 9/79 Hyponasality and nasal obstruction. Refuses further surgery. |
| R. M./2–16–64 | Cleft secondary palate Pierre Robin anomalad | 5/66-Palatoplasty | Moderate hypernasality | 10/72 Superiorly based lined pharyngeal flap. Pharyngeal defect closed. No antibiotics given. | 1/76 Denasality, nasal obstruction. Growth arrest. | 1/76 Flap taken down. Post pharynx left open. Recurrent nasal obstruction.<br>3/77-flap taken down, all raw areas closed with local flap. | 6/77 Normal nasal balance, weight gain, good airway. |

operatively. One (J. S.) had a draining ear with a tympanic membrane perforation and cervical adenopathy. Another (H. B.) had a preoperative temperature elevation to 100° with a mild leukocytosis (10,600) and a left shift; no source of the fever was identified. The third (M. T.) was noted to have an inflamed pharynx intraoperatively. A pharyngeal culture revealed staphylococcus aureus resistant to Penicillin, the antibiotic given intra- and post-operatively.

Two patients developed post-operative infections. One (S. H.) had a post-operative fever (101°), leukocytosis, and bleeding requiring transfusions. Unfortunately, no pharyngeal culture was obtained. The other (J. H.) had pharyngitis post-operatively with staphylococcus aureus and parainfluenzae cultured. One patient (N. B.) demonstrated no obvious infection but did run a low grade (100° axillary) fever for several days post-operatively.

Two patients (J. M. and R. M.) who did not demonstrate evidence of post-operative infection were distinguished from the remainder of the eight patients in that both had Pierre Robin Anomalad. One of these two patients (J. M.) had respiratory distress after every surgical procedure and respiratory arrest after each of the last two procedures.

Seven of our eight obstructed patients have been re-operated upon with good results, one (R. M.) requiring two procedures. The final patient (J. M.), who had multiple respiratory arrests, refused any further operations.

## Discussion

We were distressed to find a high incidence of nasal obstruction (10%) in this group of patients. Before this study, we were cognizant of only a few cases of significant hyponasality or nasal obstruction following pharyngeal flap surgery. Our patients often did not complain of the obstruction as such. It was only found by thorough questioning and examination. Inability to breath through the nose is obvious when specifically examined for but is often overlooked in the casual followup visit. We had not previously adequately questioned our patients regarding hypersomnolence, snoring, personality disturbances, growth arrest, loss of appetite, exercise tolerance, chronic daytime fatigue, and nasal drainage. Even patients with overtly hyponasal speech were often not recognized as having a significant problem. We naively accepted the explanation, "I just have a cold." Closer questioning often revealed a perpetual cold to be, in fact, significant nasal obstruction. Many patients had been examined by several different physicians (Plastic Surgeons, Otolaryngologists, and General Practitioners) over a period of years because of persistent nasal stuffiness and foul smelling drainage without the true etiology being recognized.

We know now that many of these patients had developed nasal obstruction secondary to port stenosis or total occlusion after their pharyngeal-flap surgery. Even when snoring, sleep disturbances, daytime fatigue, and decreased exercise tolerance are recognized, these symptoms are not often associated with the pharyngeal-flap surgery. Some patients have even demonstrated poor appetite, difficulty in eating, and growth arrest. These symptoms have resolved with division of the flap and relief of nasal obstruction. Thus, it would seem that the problem may be a simple mechanical one associated with decreased sense of smell secondary to decreased or absent nasal airflow resulting in lessened olfactory appreciation, along with difficulty in chewing and swallowing secondary to inability to chew and swallow and simultaneously breath through the nose. Sleep disturbances, hypersomnolence, snoring, personality changes, and chronic fatigue might be the result of chronic nocturnal alveolo-hyperventilation secondary to upper airway obstruction. Although others have demonstrated changes in EEG sleep patterns and decreased nocturnal $PO_2$ with upper airway obstruction, we did not study this problem in our patients. It is interesting, however, that their symptoms resolved with relief of their nasal obstruction.

It is unfortunate that the etiology of these problems in some of our patients went unrecognized for several years. We suspect there may be patients elsewhere who have similar problems which have been overlooked. Although none of our patients developed cardiac or pulmonary problems secondary to nasal obstruction, this is a real and potential problem. We should note that these eight patients all had significant nasal obstruction to the point that they could not breath exclusively through their noses. In addition, although many patients demonstrate varying degrees of

nasal obstruction in the immediate post-operative period, none of our eight improved with time (1½+ to seven years). Persistent post-operative nasal obstruction, for whatever reason, should be evaluated and treated.

Development of nasal obstruction in our series did not correlate with the primary disease process, the particular surgeon, or the type of procedure done. Post-operative nasal obstruction did correlate with the development of infection. In contradistinction to what one would expect from infection (delayed healing or flap dehiscence) we found excessive scarring and flap shortening with resultant port occlusion. Three of our patients were operated upon initially in the presence of a low grade infection and subsequently developed nasopharyngeal obstruction. Any child with preoperative evidence of a recent infection should have surgery postponed in spite of the objections from the parents and referring physicians.

Post-operative infections should be watched for and treated vigorously. In an earlier unpublished study at this institution on the use of antibiotics in cleft palate surgery, we were unable to show a decrease in the complication rate using antibiotics. Prophylactic antibiotics might be indicated in pharyngeal-flap surgery, however, if started pre-operatively, continued intraoperatively, and for a brief period, post-operatively. A larger series would be needed to confirm this. Throat cultures obtained several days pre-operatively could identify those patients at high risk so that surgery could be deferred. Children with histories of ear problems should be examined carefully by someone experienced in these problems and then treated appropriately prior to pharyngeal surgery.

Infection aside, we found that the children who fit the Pierre Robin Anomalad are at high risk for airway obstruction after pharyngeal flaps (100% in our series). One child (J. M.), after airway problems following each surgical procedure and nasal obstruction following her pharyngeal flap, has refused any further surgical procedure. Six years following her pharyngeal-flap surgery she is still unable to breath exclusively through her nose. We had hoped that her airway would improve with time, but the improvement has been minimal. We have seen one patient with Pierre Robin Anomalad (not included in this series) who had had total nasal obstruction for 13 years following her pharyngeal-flap surgery. She had been examined by more than a dozen physicians during that time without the correct diagnosis being made. Fortunately, her obstruction has been corrected by division of her flap and scar and, in this case, skin grafts to line open raw areas. This observation is in agreement with the experience of others (Jackson et al., 1976), who feel that children with the Pierre Robin Anomalid are at high risk for airway obstruction following pharyngeal-flap surgery. It would seem that these patients have a persistent marginal nasopharyngeal airway and are often unable to tolerate further surgical insults. We would recommend extreme caution in using pharyngeal flaps in these patients either as a primary or secondary procedure.

The findings at the time of flap revision have ranged from a dense thick mass of scar totally obliterating the choanae, to a thin veil-like membrane. In some cases, the ports were not totally occluded, but flap shortening had distorted them to the point that their support was lost, allowing the walls to collapse. This results in nasal obstruction or a flap valve effect allowing undirectional air passage only. We found nasopharyngograms and nasopharyngoscopy to be of little value in evaluating patients with significant nasal obstruction. Often a nasopharyngogram would show a trickle of dye passing through the ports even though we clinically were unable to demonstrate significant airflow. The panendoscope, while very educational to the surgeon, simply confirmed port occlusion. Obstruction following pharyngeal-flap surgery should perhaps be differentiated from true nasopharyngeal stenosis occurring after massive pharyngeal infections, which leave such a dense scar that repair is difficult and unpredictable. We found division of the flap to be a technically straightforward procedure with a predictable and beneficial result.

All obstructed patients have benefited from revision, either flap division or port enlargement, with restoration of normal nasal balance and improved nasal breathing. Division of the flap with closure of all raw surfaces is technically less difficult than port adjustment and surprisingly yields a successful result. It seems that the residual pad of tissue on the posterior pharyngeal wall and palate, along

with the palatal elongation and the pharyngoplasty effect occurring with the original procedure, may contribute to velopharyngeal competence after flap division. In one case (R. M.), where a large posterior raw surface was left open after flap division, nasal obstruction recurred. On reoperation, we found that scar contraction had deformed and occluded the airway. Closure of all raw areas with local flaps corrected the problem.

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