
Treatment of Bilateral Abductor Abnormalities of the True Vocal Folds: Two Case Presentations

Traitement d'anomalies de l'abducteur bilatéral des vraies cordes vocales: présentation de deux cas

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Abstract

Patients with bilateral true vocal fold midline fixation subsequent to bilateral abductor paralysis or cricoarytenoid joint disease usually present with a compromised airway, but may exhibit acceptable or good voice quality due to the position of the vocal folds. Short-term management options usually include tracheotomy; long-term options involve vocal fold lateralization techniques. The focus of this paper is to describe two specific treatment options, one surgical (vocal fold lateralization) and one surgical-prosthetic (tracheotomy and use of a Passy-Muir valve). Advantages and disadvantages of these methods are outlined. Clinical concerns related to voice effectiveness for each particular method of management, the potential for voice change, as well as the need to allow the patient to make an informed management choice are discussed.

Résumé

Les patients atteints d'une fixation médiane des vraies cordes vocales faisant suite à une paralysie de l'abducteur bilatéral ou à une maladie de l'articulation crico-aryténoïdienne ont généralement les conduits endommagés, mais peuvent présenter une qualité vocale bonne ou acceptable en raison de la position des cordes vocales. Les possibilités de soins à court terme comprennent généralement la trachéotomie et les possibilités de soins à long terme, les techniques de latéralisation des cordes vocales. Cet article vise à décrire deux options de traitement précises, l'une chirurgicale (la latéralisation des cordes vocales) et l'autre chirurgicale-prothétique (la trachéotomie et l'utilisation de la valve Passy-Muir). L'article décrit les avantages et les inconvénients de ces méthodes. Il traite en outre des questions cliniques liées à la qualité vocale pour chaque méthode de soins, des possibilités de changements de la voix et de la nécessité pour le patient de pouvoir faire un choix éclairé.

Bilateral abductor abnormalities of the true vocal folds are less common than other laryngeal disorders that are seen clinically (Boone & McFarlane, 1988). Abduction disturbances may be a consequence of disruption to the innervation of the

laryngeal musculature or a result of cricoarytenoid joint abnormalities. Bilateral midline fixation of the true vocal folds results when recurrent laryngeal nerve (a branch of cranial nerve X) control of the glottal abductors is impaired or when disease within the cricoarytenoid joints prevents mobilization (i.e., fixation) of the arytenoid cartilages. Bilateral neurological impairment of abductor musculature may result from injuries such as traction of the nerves during blunt trauma to the neck. However, the most common cause of cricoarytenoid joint fixation is rheumatoid arthritis (Bridger, Jahn, & van Nostrand, 1980). Regardless of etiology, abductory disorders of the true vocal folds often have a similar clinical presentation, and the typical presentation of individuals with abduction abnormalities often does not include a primary complaint of voice symptoms. Rather, patients with midline fixation of the vocal folds subsequent to bilateral paralysis or cricoarytenoid joint disease usually present with a compromised airway, yet may exhibit good or acceptable voice quality.

From a physiologic perspective, the presence of a good voice is a result of sufficient adduction of the vocal folds. It should be noted at this point that movement abnormalities in the laryngeal mechanism are identified by what the vocal folds *cannot* accomplish (Boone & McFarlane, 1988). Thus, in *abduction* disorders the vocal folds cannot open or abduct; in *adduction* disorders, the vocal folds cannot close or adduct. Hence, in abduction disorders sufficient opposition to exhalatory airflow is accomplished because the vocal folds are at or near the anatomical midline of the glottis. Thus, while patients with abductory disorders complain of respiratory difficulty (dyspnea) and often exhibit noisy breathing or inspiratory stridor, the strength and overall quality of their voice may be near normal expectations. This is due to the patient's ability to create vocal fold oscillation as a result of their inability to abduct the folds. Despite the patient's vocal function capabil-

ities, concerns related to the adequacy and maintenance of the patient's airway are of utmost importance.

Generally, emergency treatment of bilateral abductor mid-line fixation abnormalities has involved bypassing the airway obstruction by performing a tracheotomy, while long-term options involve physically displacing one of the true vocal folds laterally, thus enlarging the glottal aperture. This is achieved through the use of one of several surgical techniques for vocal fold lateralization (Dedo & Dedo, 1980; Ossoff, Duncavage, & Knox, 1990). The purpose of this clinical report is to describe two patients who underwent different treatment options following evaluation and diagnosis of bilateral abductor vocal fold abnormalities. The specific focus is to describe the individual management option each patient chose, one which was surgical alone (a vocal fold lateralization procedure) and one which utilized a surgical-prosthetic approach consisting of a permanent tracheotomy and the use of a Passy-Muir valve (Passy, 1986). Aspects of each management method will be presented and discussed. Issues relating to the cooperative efforts of the speech-language pathologist and laryngologist in patient care are also presented.

Case Reports

Subject 1

A 76 year old woman presented with a 30 year history of shortness of breath and associated poor exercise tolerance. She also had a history of rheumatoid arthritis. She reported repeated and often severe episodes of stridor and had been diagnosed at one point as having asthma, which was usually associated with upper respiratory infections. In June 1989, this woman underwent an emergency tracheotomy for acute respiratory distress following the onset of a severe upper respiratory infection.

Preoperative examination of this patient by a laryngologist (G.F.M.) using rigid and flexible videoendoscopy revealed the presence of a submucosal collection of calcium like deposits in the area of the arytenoid cartilages. These deposits are commonly seen in patients with rheumatoid arthritis (Bridger, Jahn, & van Nostrand, 1980). Clinical examination of the patient indicated a bilateral abduction abnormality of the true vocal folds. The provisional medical diagnosis was bilateral arytenoid fixation as a probable consequence of her

arthritis. Her condition deteriorated as a result of respiratory infections. The subject refused an electromyographic (EMG) assessment which would have confirmed the presence or absence of neurological impairment to abductor innervation (Blair, Berry, & Briant, 1978; Hirano, Nozoe, Shin, & Maeyama, 1987; Ohyama, Ueda, Harvey, Mogi, & Ogura, 1972). There was no indication of an asthmatic condition which may have influenced laryngeal function (Wood, Jafek, & Cherniack, 1986). Overall, voice quality was within normal limits for pitch and loudness, however, some increased "roughness" (i.e., aperiodicity) was noted perceptually in the vocal signal. This woman specifically refused surgery to increase the glottal opening when she was informed that her postsurgical voice may be reduced in intensity and may be characterized by sufficient breathiness as a possible consequence of establishing a good airway for ventilatory purposes. The patient stated that she liked to "talk a lot" and was not willing to accept the potential reductions in her voice. Based on the respiratory difficulties experienced by this woman, she was fitted with a Passy-Muir tracheostomy speaking valve for speech purposes.

Briefly, the Passy-Muir tracheostomy speaking valve (Passy, 1986) is similar to a standard tracheostomy tube. However, the unique aspect of this device is that it permits voicing without digital occlusion of the tracheostomy tube. That is, the Passy-Muir tracheostomy speaking valve is a one-way pressure-sensitive device which responds to exhalatory airflow. This pressure sensitivity permits closure of the speaking valve with an increase in respiratory pressure when voicing is desired.* Thus, both hygienic aspects related to digital occlusion of the tracheostomy valve for voice/speech purposes as well as potential communication restrictions associated with such a manual occlusion maneuver are eliminated. This permits the speaker to communicate in a much more natural manner, which may facilitate communicative interactions and decrease the potential for stigmatization.

The patient was informed of the potential problems associated with permanent tracheotomy and use of the speaking valve; these issues were discussed with her in detail. This patient was not disturbed about the tracheotomy and believed that the Passy-Muir valve could provide her with adequate speech for her daily communicative activities. She expressed no reservations about the possible aesthetic limitations which might be associated with use of this prosthetic device.

Course of Subject 1

This patient has been seen for postoperative, cooperative follow-up by laryngology and speech-language pathology on a regular basis over the past 12 months. She has not experienced difficulties with her tracheotomy or the Passy-Muir

* For detailed information on the development, design, and use of the Passy-Muir tracheostomy speaking valve, the reader should consult the information reported by Passy (1986) or contact Passy & Passy, Inc. (4521 Campus Drive, Suite 273, Irvine, CA, USA, 92715).

tracheostomy speaking valve, even at times of upper respiratory infections. She also reports that the permanent tracheostomy and speaking valve has not limited her activity; in fact, the patient reports that she is now substantially more active than prior to the procedure. She has also denied any communication difficulties associated with the Passy-Muir valve and is active in social and avocational activities. This information has been confirmed by family members. In our opinion, this patient is an excellent user of the Passy-Muir valve and exhibits no communication difficulties or apprehension in her communicative interactions. Voice recordings obtained during the follow-up period have indicated little or no change in her voice from that noted preoperatively. This subjective judgment has been confirmed by acoustic assessment of the patient's voice.

Subject 2

This 42 year old woman sustained a blunt neck trauma as a result of a motor vehicle accident in 1984. Laryngeal fracture was ruled out by clinical and radiological examination. The patient underwent emergency tracheotomy to provide an adequate airway. Reportedly, following extubation, her voice was characterized by a "hoarse" quality. In 1988 she underwent an excision of soft tissue in the subglottic region at another facility. Postoperatively, the procedure proved to be unsuccessful in alleviating her airway problem. She was referred to our facility for evaluation in June 1989. At the time of our initial evaluation, the patient reported shortness of breath and extremely poor exercise tolerance. In fact, the patient indicated that she was unable to walk one block without respiratory difficulty. She also was observed to exhibit significant stridor. The patient reported that her shortness of breath worsened with colds and upper respiratory infections. Consequently, the patient made repeated visits to the hospital emergency room for breathing difficulties.

Visualization of the patient with both rigid and flexible videoendoscopy revealed a bilateral abductor abnormality as a likely sequelae of her neck trauma. The laryngeal mechanism was characterized by a small glottal chink along the entire length of the glottis during quiet breathing. There was impaired vocal fold movement bilaterally with greater limitation of the right fold than of the left. This patient also refused laryngeal EMG. The patient's vocal quality was characterized by significant roughness (aperiodicity) in the presence of adequate intensity.

Following discussion of our findings with the patient, she chose to undergo an arytenoidectomy and surgical lateralization of the right vocal fold. In this procedure, one arytenoid cartilage is removed, and the vocal fold is surgically lateralized in order to provide an increased glottal aperture. The primary

goal of the procedure is to improve the airway by repositioning one fold away from the midline. The patient was informed that this procedure could result in deterioration of her voice, specifically, that the surgical procedure would likely result in increased breathiness and decreased intensity. Counselling was provided on this potential postsurgical consequence. The patient was not concerned about the likelihood of a change in her voice, but was adamant in her desire to breathe without difficulty. Sufficient information and follow-up counselling was provided to this woman prior to her request for and scheduling of the surgical procedure.

Course of Subject 2

Assessment of this patient one week postoperatively revealed a substantial increase in the glottal area during quiet breathing following the lateralization procedure. Our regular follow-up of this woman indicates that she now has excellent exercise tolerance and reports no physical limitations. However, her voice is low in volume and remains rough. Further, at times her voice is characterized by a harsh quality (Fairbanks, 1960) which we have visually documented using videonasoscopy as being associated with a compensatory supralaryngeal "squeeze" during phonation (Pershall & Boone, 1986). This behavior was particularly evident as the patient's air supply became depleted during speech production. While an excellent airway was achieved through the arytenoidectomy and lateralization procedure, there was a subsequent reduction in the overall strength and quality of this patient's voice. Although this does not appear to be a problem for this particular patient, her voice was altered as a result of the surgical procedure.

Discussion

Based on our evaluation and observation of these two patients, several issues deserve comment. Initially, it is important to acknowledge that the primary treatment goal for bilateral abductor abnormalities is one of providing an adequate airway. Although the method of treatment, whether it be surgical alone or a combined surgical and prosthetic approach, appears to have direct consequences on the integrity of the vocal mechanism, voice is not a primary concern; the primary problem is asphyxia due to an inadequate airway. As a result of the specific treatment options each of these patients pursued, different voice outcomes were noted. Secondly, each patient selected their own treatment option following counselling by the speech-language pathologist and laryngologist.

To date, Subject 1 has refused further surgery but, using the Passy-Muir tracheostomy speaking valve, exhibits a voice which is essentially unchanged from that noted prior to the

tracheotomy. Further, this patient exhibits an excellent airway and has not experienced any breathing problems. In contrast, Subject 2 exhibits a good airway and excellent exercise tolerance; however, her voice capabilities have decreased and her voice is characterized by a weak, breathy quality with subsequent reduction in vocal loudness and overall strength, and occasional harshness. While medical management was directed at airway maintenance because both subjects exhibited impaired breathing due to obstruction of the airway, only Subject 2 experienced concomitant changes in her voice. Both patients continue to be followed cooperatively by laryngology and speech-language pathology at regular intervals, and the course for both patients has remained stable over the 15 month postoperative period.

Our experience with these two patients suggests that specific advantages and disadvantages exist for these two treatment methods for bilateral abductor vocal fold abnormalities. The advantages of the surgical-prosthetic approach include the fact that a good airway for ventilation may be established and maintained. Additionally, vocal limitations, at least in most cases, would appear to be minimal because of the position of the vocal folds in the midline. However, differences between individual patients will likely exist and must be viewed accordingly. That is, voice quality using the speaking valve may vary across patients, and the postsurgical outcome cannot be estimated with certainty. Several disadvantages of the surgical-prosthetic approach must also be acknowledged, the most important being that the patient must fully understand the potential problems that are associated with a permanent tracheotomy. This concern cannot be understated and includes the potential for both immediate and delayed complications (Seid & Thomas, 1980). Specific concerns associated with permanent tracheotomy include the need for and cost of continual care of the tracheostomy tube and stoma, the potential for recurrent and perhaps serious pulmonary infections, and a rare but real concern of massive bleeding due to erosion of the innominate artery. Further, patients must be counselled regarding this treatment option to insure that they fully understand the basic principles of speaking valve use and that they are able to manage the Passy-Muir speaking valve independently.

The primary advantage of arytenoidectomy and vocal fold lateralization is that a good airway can be established and maintained independent of a tracheotomy and an associated prosthesis. The major disadvantages of vocal fold lateralization include a significant failure rate, as well as potential surgical complications such as airway fires when a laser is used and postoperative infection. Additionally, sufficient voice limitations may exist postoperatively. As a consequence, reduction in voice quality at times may be substantial and permanent. For example, such patients may have extreme difficulty communicating in even moderately quiet environments due

to their increased breathiness and concomitant reduction in vocal loudness.

Conclusions

In summary, the clinical management of patients with bilateral abductor abnormalities of the vocal folds raise several important clinical concerns. These concerns are best managed through the cooperative efforts of the laryngologist and the speech-language pathologist working together with the patient during the evaluation process, as well as during follow-up visits. The speech-language pathologist must remember that maintaining an airway is the primary concern and that subsequent voice changes that occur as a consequence of establishing an airway are secondary to biological, ventilation needs. The surgeon must, however, consider that the alteration of voice resulting from the procedure chosen by the patient, of which there are several, will be permanent. The speech-language pathologist must understand the basic concepts of the surgical procedure to be undertaken and its resulting restrictions on function of the vocal mechanism. This type of information provides the speech-language pathologist with an appreciation of the structure and potential function of the postsurgical laryngeal mechanism. Thus, prudent and realistic voice management goals and strategies for the patient may be facilitated.

Finally, clinical concerns pertaining to vocal function should always be directed at the potential effectiveness of each particular treatment option in conjunction with a realistic assessment of the relative disadvantages. That is, one patient's needs and desires may differ from another's, and certain options, such as tracheotomy and use of the Passy-Muir valve, should not be disregarded or discouraged by the clinician. Each patient must, however, understand the relative advantages and disadvantages of each option. As such, a risk-benefit evaluation of each treatment method should be a mandatory component of the cooperative clinical counselling of these patients. If patients are provided with adequate information from which they can make an informed choice, the chance that a successful outcome will be achieved will certainly be enhanced.

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