Treatment of Functional Ventricular Fold Phonation by Temporary Suture Lateralization

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Summary: Ventricular fold phonation (VFP) is a phenomenon characterized by phonation using the false vocal folds. Besides a substitution voice due to loss of the true vocal folds—so called compensatory type—the noncompensatory types have a psychogenic, functional, or habitual background. Therapeutic options for these cases so far comprise voice therapy, pharmacological therapy (injection of anesthetics or botulinum toxin), and, in case of failure, surgical resection of the ventricular folds. Indication for aggressive surgical interventions is usually difficult, as there is always a risk of producing an irreversible state with an even worse situation.

We present two cases of functional (psychogenic) VFP treatment refractory to conservative treatment. Lateralization of the ventricular folds by an endo-extralaryngeal temporary suture, similar to that used in bilateral vocal fold paralysis, was performed. Immediately after the procedure, a constant phonation at glottic level could be achieved in both cases. Sutures were removed 4 days after surgery, and phonation remained at the glottic level. Vocal fold phonation could be stabilized in the long run, and both patients recovered completely under additional voice therapy.

Key Words: Functional ventricular fold phonation–Surgical treatment.

INTRODUCTION

The ventricular folds physiologically move together with the arytenoid cartilages to assist glottic airway closure, though they do not cover the true vocal folds during normal voice production.1,2 Ventricular fold phonation (VFP) can be a substitute for true vocal fold phonation in case of loss or damage of the vocal folds. In contrast to this, noncompensatory VFP can be a result of supraglottic hyperfunction caused by habits or psychogenic origin. The voice resulting from VFP is mainly characterized by a rough, low-pitched quality, sometimes accompanied by voice breaks and diplophonia.1,3

Several treatment options are described depending on the etiology, comprising voice therapy, psychotherapy, botulinum toxin, or anesthetic injections, and, in case of failure, surgical resection of the ventricular folds.3 As the ability of the true vocal folds to vibrate normally very often remains unclear, decision making for performing aggressive surgical interventions can be difficult and bears the risk of worsening the situation and producing even aphonia.

An approach with minimal risk is to temporarily lateralize the ventricular folds with an endo-extralaryngeal suture technique similar to that used for vocal fold lateralization in bilateral paralysis.4,5 We present two cases of treatment refractory functional (psychogenic) VFP that could be treated with a temporary suture lateralization very quickly and sufficiently.

MATERIAL AND METHODS

Voice assessment
Voice assessment was done according to European Laryngological Society guidelines.6 Acoustic parameters were assessed by

the Multi Dimensional Voice Program (KAYLAB Signal Analysis Workstation, Model 3700 – 32 bit, Version 2.2, 1999 Kay Elemetrics Corp., USA). The samples were recorded by using the original headset, placed 10 cm in front of the subject’s mouth. Subjective voice impairment was measured using the German version of the Voice Handicap Index in its short form (VHI–12) as developed by Nawka.7,8 This inventory consists of 12 questions derived from the original VHI and results, therefore, are in a range between 0 and 48.

Surgical technique

The surgical technique was performed according to that described by Lichtenberger for vocal fold lateralization in bilateral vocal fold paralysis.4,5 In jet ventilation, the larynx was exposed and a monofilamentic nonabsorbable suture was placed below the ventricular folds (ie, within the laryngeal vestibule) and above the ventricular folds using the Lichtenberger needle carrier. The suture was pushed through the neck skin and noted only with a gentle pull over a button under direct endolaryngeal vision controlling the effect (Figures 1 and 2).

Case report 1.

Patient one is a 13-year-old boy who suffered from recurrent hoarseness for 2 years. From this time on the boy gained weight intensively up to 80 kg (152 cm; BMI 34 kg/m2). Prior to his first visit, he suffered from an acute laryngitis. His deep harsh voice was very irritating and disturbing, especially in school, and several treatment attempts including antibiotics, antiphlogistics, and short-term voice therapy have been done without success. Laryngoscopy showed a normal larynx (Figure 1A) with full ventricular fold adduction and a constant phonation on the ventricular level (Figure 1B). Voice assessment revealed an abnormal, deep, severely disturbed voice (Table 1). Interestingly, he denied any subjective voice problem (VHI–12: 4 = no handicap). A psychological exploration revealed severe private and school-related problems. His parents got divorced 3 years ago with ongoing problems. His emotional situation was very unstable and fluctuated between extremely friendly, polite, and aggressive, denying any problems. Psychogenic origin of the VFP was therefore diagnosed, and additional psychotherapy was strongly advocated. However, the apparent
psychosocial factors were denied by the boy’s parents (mother is a general practitioner), and psychotherapy was refused. Voice therapy did not lead to constant voice use on glottic level, so after 4 months, we performed a lateralization of the ventricular folds by an endo-extralaryngeal suture (arrows). Immediately after the procedure, a constant phonation at glottic level could be achieved. The sutures were removed 4 days later, and voice therapy continued. After the removal of the sutures, the phonation remained at the glottic level (Figure 1E and F), although he still was able to change between ventricular and glottic phonation consciously. Voice assessment revealed a clear voice with normal limits; mean F0 increased to 196 Hz. Although claiming not having any voice problems initially, he expressed his appreciation of his “new” voice (VHI–12: 0 = no handicap) (Table 1). According to regular logopedic follow-ups, his situation is stable since 1 year now, although the psychosocial situation remains problematic, and we constantly try to influence the parents to seek psychological help.

Case report 2. Patient two is a 35-year-old female kindergarten teacher with a heavy voice load. For 1 year after a reported respiratory tract infection, she suffered from heavy dysphonia and intermittent aphonia but was still at work. She was treated with antibiotics, antiphlogistics, and repeatedly underwent voice therapy, psychotherapy, and several other therapeutic attempts including local anesthesia of the larynx without any success. She is a heavy smoker and refluxer and was, therefore, put on long-term proton pump inhibitor. Laryngoscopic examination showed signs of chronic laryngitis, with a strong adduction of the ventricular folds during phonation (Figure 2A). The
voice was very low (139 Hz), extremely hoarse, and reduced with respect to all voice parameters (Table 2). Especially because of her professional situation, she was very affected by her voice problem (VHI–12: 22 = medium to extreme handicap). Psychological evaluation revealed a strong suspicion of underlying psychosocial factors. However, the patient was very reluctant to accept and refused any further psychotherapy. Here again, lateralization of the ventricular folds by endo-extralaryngeal suture technique was performed (Figure 2B). Immediately after the procedure, constant phonation at glottic level occurred resulting in a dramatic voice improvement. After the removal of the sutures 4 days later, the phonation remained at the glottic level (Figure 2C). Mean $F_0$ increased to 185 Hz, hoarseness decreased from severe to moderate, and all voice parameters were in the normal range. Since the procedure, the patient’s voice production is permanently on the glottic level. Subjective voice impairment decreased completely (VHI–12: 3 = no handicap).

**DISCUSSION**

According to Sataloff, ventricular dysphonia is defined as “phonation using false vocal fold vibration rather than true vocal fold vibration, most commonly associated with severe muscular tension and occasionally may be an appropriate compensation for profound true vocal fold dysfunction.” The ventricular folds are composed of fibers of the thyroarytenoid and the lateral cricoarytenoid muscle, which are both innervated by the anterior division of the recurrent laryngeal nerve. Current pathophysiological approaches assume that by continuous increased ventricular activity, the false vocal folds develop signs of

<table>
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<tr>
<th>TABLE 1. Case 1: Pre- and Postoperative Voice Assessment</th>
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<tr>
<td>Case 1 (13 y, Male)</td>
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<tr>
<td>Hoarseness</td>
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<td>Breathiness</td>
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<td>Roughness</td>
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<td>Jitter (%)</td>
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<td>$F_0$ (Hz)</td>
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<td>Lowest frequency (Hz)</td>
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<td>Maximum phonation time (s)</td>
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<td>Phonation quotient (l/s)</td>
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<td>VHI–12</td>
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Abbreviation: VHI, voice handicap index.
patients recovered immediately from long-lasting and other-
VFP (Figures 1 and 2). In combination with voice therapy, both
as a new and elegant method for treatment of noncompensatory
therapy,3 psycho-
nation. In noncompensatory VFP—as in our cases—the
pends on whether or not the true vocal folds are capable of pho-
tropy. Maryn et al categorized VFP into four different
types; the first is called compensatory type as a reaction to
tue vocal fold disease (paralysis, true vocal cord surgery
e.). The other types are noncompensatory with the vocal folds
able of normal vibration. The second type is entitled habitual
type caused by hyperkinetic vocal abuse; the third type psycho-
emotional is provoked by physical and psychogenic tension
and distress; the fourth type is called idiopathic.3
Essentially, therapy is strongly related to etiology and de-
ends on whether or not the true vocal folds are capable of pho-
nation. In noncompensatory VFP—as in our cases—the
therapeutic armamentarium comprises voice therapy,3 psycho-
therapy,2 pharmacological therapy (injection of anesthetics12 or
botulinum toxin13 into the ventricular folds), or surgery. The
first steps of treatment consist of voice therapy, in most cases
combined with psychotherapy. If this does not lead to a recovery
of normal voice function, surgical treatment of the vocal folds is
an option. Former studies reported that resection of the ventric-
ular folds not only leads to satisfactory results but also to an
irreversible state and might worsen the situation.14
We present a temporary lateralization of the ventricular folds
as a new and elegant method for treatment of noncompensatory
VFP (Figures 1 and 2). In combination with voice therapy, both
patients recovered immediately from long-lasting and other-
wise therapy-resistant VFP (Tables 1 and 2). Although this ther-
apy of course does not influence the underlying cause in case of
habitual or psychosocial disturbance, it can break a vicious
circle. Whatever the cause or origin of VFP is, the constantly
increased ventricular function and repetitive closure may lead
to functional and anatomical changes in the intrinsic laryngeal
muscles and possibly to an altered innervation pattern.14 It
seems that similar to functional (psychogenic) aphony, when-
ever a VFP has established over a longer period, the neuromus-
cular patterns are consecutively engraved such that they will not
change even if the underlying cause/conflict has been treated
successfully. Mechanically hindering the ventricular folds to
adduct and thus allowing the vocal folds to vibrate again is ap-
parently a strong activator of the normal laryngeal function. It is
essential to explain to the patient carefully the nature of his/her
disorder and that an operation will not be a definite solution to
the problem but the starting point for additional voice- and psy-
chotherapy. Interestingly, both of our patients (parents, respect-
ively) refused to undergo further psychotherapy. As the
temporary lateralization is a quick and low-risk procedure
that can be reversed at any time without leaving destruction
to the larynx, it can be used as a testing procedure in case of un-
certainty about the true vocal fold function.

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