Pediatric Vocal Fold Nodule Etiology: What Are Its Usual Causes in Children?

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Summary: Objectives. In this study, the relation between phonotrauma and presence of siblings and social activities was investigated, and the incidence of voice disorders in the mothers of children with vocal fold nodules was studied with objective (clinical voice analysis) and subjective (laryngostroboscopy, Voice Handicap Index) methods.

Methods. Twenty-nine children with vocal fold nodules (age range 5–14 years), 45 age-matched children without any voice disorders as a control group, and their mothers were included in the study. All patients had laryngostroboscopy and clinical voice analysis, and their mothers filled out the Pediatric Voice Handicap Index. We noted the most common place or situation where children used their voice in excessively high volume according to their mothers, including home, school, sportive activities, and singing or reciting poem activities, to recognize the major cause of phonotrauma. In addition, presence of siblings was recorded.

Results. It was found that 15 patients (51.7%) had younger siblings, seven patients (24.1%) had older siblings, five patients (17.2%) had both younger and older siblings, and two patients (6.8%) did not have any siblings. It was seen that excessive usage of high-volume voice at home had a correlation with presence of only younger siblings, and both younger and older siblings tended to cause phonotrauma at home (86.7%). Additionally, eight boys (44.4%) reported presence of sportive activities, whereas none of the girls had such an activity ($P = 0.012$).

Conclusion. Presence of siblings seems to be an important factor for vocal nodule formation. Maternal relationship does not seem to be a major factor for vocal misuse.

Key Words: Dysphonia–Vocal abuse–Children–Voice analysis–Stroboscopy.

INTRODUCTION

Pediatric vocal fold nodules (VFNs) are the most frequent causes of dysphonia in childhood, and they have been diagnosed in 40% of cases with voice disturbances.[1] The prevalence of VFN was 21.6% in school-age boys and 11.7% in school-age girls in Turkey.[2] Dysphonia or aphonia, straining (breathiness), and short maximum phonation time are the major findings on clinical evaluation of patients with VFN. The best method in diagnosis is laryngostroboscopy, and VFNs appear as submucosal lesions of various sizes located at the junction of anterior one thirds and posterior two thirds of the vocal folds.

VFNs usually appear in this age group because of phonotrauma, including shouting and screaming. Phonotrauma in childhood may be associated with behavioral problems of the children; however, effect of the family members and the social environment may play a role. High prevalence of VFN and functional dysphonia in 25- to 44-year-old women must be taken into account as a factor for phonotrauma in young children because there is an intensive communication between the children and their mothers in this period.[3]

VFNs that result in hoarseness and jarring negatively affect the child's relations with the social environment, school success, daily activities, and mood.[4] Although it has been reported that those lesions improve during puberty, direct and indirect therapy have been frequently used in the treatment of these lesions. The basic steps of the treatment include increasing hydration, as well as assessment of environment, family, and communications of the child, and correction of wrong behavior patterns.[5]

In this study, we investigated the relation between phonotrauma and presence of siblings, and studied the incidence of voice disorders in the mothers of the children with VFNs using objective (clinical voice analysis) and subjective (laryngostroboscopy, Voice Handicap Index [VHI]) methods, because familial and environmental factors can play a role in this disease.

MATERIALS AND METHODS

The present study was approved by the Ethics Committee of Ankara Research and Training Hospital (decree no: 0510/4263/28.06.2013). Twenty-nine children with VFN (age range 5–14 years) were included in the study. Forty-five age-matched children without any voice disorders acted as the control group. The mothers of all participants were also included in the study. Children with active upper respiratory infection, positive history or laryngoscopic finding of gastroesophageal reflux disease, or a speech or cognitive disorder were excluded. All children had laryngostroboscopy and clinical voice analysis (Kay Elemetrics (KayPENTAX, Montvale, NJ, USA)), and their mothers filled out the pediatric VHI (pVHI) for them. In addition, we asked the mothers for the most common place or situation where their children used excessively high voice, including home, school, sportive activities, and singing or reciting poem activities, to recognize the major cause of phonotrauma. Presence of siblings was also recorded to define causal factors leading to phonotrauma. The mothers of the children in both groups were given the VHI, and fundamental frequency (Fo), jitter percent (Jitt %), shimmer percent (Shim %), and noise-to-harmonic ratio (NHR) were analyzed with acoustic voice parameters. Maximum phonation time (MPT) is measured in all subjects as well. The mothers with systemic diseases or malignant laryngeal diseases as well as smokers were excluded. Previous surgery because of a benign la-

Accepted for publication October 11, 2016.
We do not have a conflict of interest or other relationships with any companies.
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Journal of Voice, Vol. 31, No. 4, pp. 506.e19–506.e23
0892-1997
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http://dx.doi.org/10.1016/j.jvoice.2016.10.007

TABLE 1.
Demographic Characteristics of the Patients With Vocal Fold Nodules

Variables		Mean ± SD	Median [Min–Max]
Age	Girls	7.9 ± 2.6	8 [5–13]
	Boys	10.6 ± 2.2	11 [6–14]
	Total	9.6 ± 2.7	10 [5–14]
Symptom duration		8.2 ± 7.7	6 [2–36]

		Number	Percentage
Gender	Girls	11	37.9
	Boys	18	62.1
Place or situation where children used their voice in excessively high pitch	Home	24	82.8
	School	12	41.4
	Sportive activities	8	27.6
	Singing, poeting performance	4	13.8

Abbreviation: SD, standard deviation.

ryngeal disorder was not considered as an exclusion criterion, and it was indicated if present.

After the children completed the pVHI, described by Zur et al,[4] and their mothers completed the adult VHI, their voices were recorded in a room with a low noise level. Acoustic parameters of voice were analyzed using KayPENTAX's *Computerized Speech Lab* model voice analysis device (KayPENTAX, Montvale, NJ, USA), and a Pentium 3.0 GHz computer with a Realtek ACX'97 voice card (Realtek, Taiwan). The voice analysis was performed after a 15-minute resting period by taking into account that they could have exercised excessively, and to avoid vocal abuse just before the test; those could affect the voice analysis negatively. Voice analysis was performed in a quiet room; the subjects phonated only the vowel "/a/" for at least 5 seconds in the acoustic voice analysis while they were sitting in an upright position, when a dynamic Shure SM48 microphone (Shure Incorporated, Chicago, İllinois, USA) was 15 cm away from the their mouths. Recordings were repeated three times, and 3-second mean values were obtained using the *Multidimensional Voice Program* Model 5105, version 3.3 (KayPENTAX, Montvale, NJ, USA).

Jitt, shim, NHR, Fo, and MPT were recorded in the voice analysis. The group with pediatric VFN was compared with a healthy control group for age, gender, pVHI index, MPT, and acoustic parameters. Mothers of the two pediatric groups were compared for the same parameters, and results were statistically analyzed.

Statistical analysis

Statistical analysis was performed using IBM *SPSS Statistics* 21.0 statistical package (SPSS, IBM, New York, NY, USA). Continuous variables were presented as mean ± standard deviation or medians (minimum–maximum). Categorical variables were summarized as frequencies and percentages. Normality of the continuous variables was analyzed with Shapiro-Wilk test. Differences between two groups for continuous variables were determined by independent samples *t* test or Mann-Whitney *U* test, as appropriate. Categorical variables were compared with Pearson chi-square test. A *P* value less than 0.05 was considered as significant.

RESULTS

The VFN characteristics of 29 (11 girls, 18 boys) patients including mean age, gender, dysphonia duration, and school-preschool age distribution are shown in Table 1. The study group consisted of 11 girls aged between 5 and 13 years (mean age: 7.9 ± 2.6 years), and 18 boys aged between 6 and 14 years (mean age: 10.6 ± 2.2 years). Duration of dysphonia was between 2 and 36 months (mean: 8.2 ± 7.7 months).

Table 2 shows the comparisons for age and gender in pediatric VFN and control groups. The control group consisted of 45 subjects (21 girls, 24 boys) with mean age of 9.0 ± 2.8 years, and the study group consisted of 29 patients (11 girls, 18 boys) with mean age of 9.6 ± 2.7 years. Age and gender distributions were similar in the two groups. The mean ages of the mothers

TABLE 2.
Comparison of Age and Gender Between Study and Control Groups

	Control Group (n = 45)	Patient Group (n = 29)	*P*
Age	9.0 ± 2.8	9.6 ± 2.7	0.361
Gender (girls/boys)	21/24 (46.7%/53.3%)	11/18 (37.9%/62.1%)	0.617

	Mothers of the Control Group (n = 45)	Mothers of the Study Group (n = 29)	*P*
Age	34.3 ± 6.6	34.5 ± 5.3	0.925

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