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Epidemiological study on vocal disorders in paediatric age

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Key words

Dhysphonia • Paediatric age • Epidemiology

Summary

Few studies analyzed the diffusion of vocal alterations especially in childhood. Aim of our study was to quantify the numbers of subjects, in paediatric age, in which dysphonia was diagnosed in our department of Phoniatrics, during a period of 5 years, (January 2002-December 2006), and also to evaluate the influence of some potential risk factors. In the considered period it emerged that the diagnosis of dysphonia was made in 312 children (17.2% of the patients affected from dysphonia), aged between 2 and 16 years old, with a major prevalence amongst males (57%) than females (43%). On the contrary in the adult population the prevalence was: 23% in males and 77% in females. In paediatric population, the most affected range of age is the one between 8 and 14, in both male and female gender (59.6%). In 82.4% of the cases there were vocal fold lesions. The 90.3% of children with vocal fold alterations presented lesions secondary to vocal abuse and misuse and classifiable as functional dysphonia. The proportion of functional dysphonia in our sample was 92%. The 65% of children belonged to large families with more than two children, and the 30% had a family history of dysphonia (brothers, parents). The study of the behavioural characteristics has shown aggressive and hyperactive attitudes in 83% of the cases. Since in the ethiopathogenesis of the childhood dysphonia the tendency to vocal abuse has a predominant role, it would be useful to encourage the diffusion of programmes of information to show the risks linked to this abuse in children, in order to prevent the development of dysphonia in paediatric age.

Introduction

Valid and reliable epidemiological information on voice disorders would greatly enhance our ability to plan future health-care provision. Unfortunately, information on prevalence of dysphonia is very limited. Some prevalence data exist for adult voice disorders, but this is confined to specific groups of professional voice users (preachers, teachers, singers) [1, 2] or specific pathological conditions (Parkinson's disease, gastro-esophageal reflux) [3, 4]. One study of occult laryngeal pathology in a community-based cohort identified prevalence of voice disorders as 72% [5].

Reports of childhood dysphonia describe prevalence between 6% and 38% of school-aged children [6]. Wilson [7] describes the results of several early American studies and reports similar prevalence figures. However, most voice surveys were conducted over 30 years ago, and the relevance of these data to today's paediatric population is unclear.

Childhood dysphonia incidence figures have been cited as 6% to 23% [8, 9], although, again, it is often not clear how these data were calculated.

Many early voice survey studies, as summarized by Wilson [7], report prevalence among school-aged children in general (5-18 years) with no further information about relative prevalence at particular ages. The available primary/kindergarten prevalence data would suggest higher figures than later years. However, there is no comparative data for later age groups.

Carding et al. [10] examined the prevalence of dysphonia in a large cohort of children (7,389) at 8 years of age, identifying a dysphonia prevalence of 6%.

The most frequent causes of childhood dysphonia are vocal fold nodules, which have been found in 38-78% of children evaluated for chronic hoarseness [11], but other vocal fold lesions, such as localized edema and irregularity at the junction of the anterior and middle third of the vocal folds, have recently been found in 13.3% of the 617 children examined [12]. Common adult laryngeal diseases, such as recurrent laryngeal paralysis, or vocal fold polyps or cysts, are only seldom found in children.

Few studies analyzed the relevance of predisposing factors, such as large family (sibling) dynamics [13-15] and specific behavioural characteristics [16].

This study aims to examine how many children received the diagnosis of dysphonia from January 2002 to December 2006 in our Phoniatrics department and the kind of vocal fold lesions eventually presented. Potential risk factors such as age, sex, sibling numbers, familiar history of dysphonia and behavioural characteristics, will also be analyzed.

Methods

We studied all subjects in paediatric age, aged between 2 and 16 years old, in which dysphonia was diagnosed after phoniatric evaluation in our department of Phoni-

atrics. We analyzed a period of 5 years, from January 2002 to December 2006.

In the phoniatric evaluation we performed:

- a thorough anamnestic evaluation, in order to analyze the general development of the child and of his pneumo-phono-articulatory apparatus, the quality of voice in early childhood, the present vocal quality, the behavioural characteristics and the vocal attitude of the child and of his family, the composition of family, the familiar history of disorder. The behavioural characteristics of children were judged by an experienced child neuropsychiatrist and using a questionnaire for parents that investigated the children behavior in family and school environment;
- laryngovideostroboscopic examination, that allows an objective evaluation of superior air tract, using a 90° or 70° rigid optic or, in exceptional cases of discomfort, a flexibile fiberoptic laringoscope [17]. This exam shows the supraglottic and glottic regions and detects vocal fold anatomy characteristics and the status of the epithelium. It also shows the vocal fold vibratory characteristics using a stroboscopic light source that realizes an optic illusion slowing down the movement of vocal folds;
- acoustic analysis of voice, using Multi-Speech (version 3700, Kay Elemetrics Corp., NJ, USA) and Multi-Dimensional Voice Program (MDVP, version 5.5, Kay Elemetrics Corp., NJ, USA) [18, 19], that realize a voice spectrography and calculate the perturbation index – jitter (Jitt%) and shimmer (Shim%) –, the noise-to-harmonic ratio (NHR), and the average fundamental frequency (Fo). MDVP's normative references are based on an extensive database of normal and disordered voices, elaborated by Kay Elemetrics, and results are graphically and numerically compared to these normative threshold values. All the voices were recorded using a microphone, positioned approximately 15 cm from the mouth, slightly below the chin, in order to reduce airflow effects. Spectrograms of the sustained vowel /a/ were recorded at FFT-1024 points ranging from 0 to 8 kHz, with a sampling frequency of 20,000 Hz. The results of MDVP are given as arithmetic mean values ± standard deviation;
- perceptual evaluation of voice, using GRBAS scale [20], that analyzes and categorizes the voice quality trough subjective parameters: the G stands for grade of overall dysphonia, R for roughness, B for breathiness, A for asthenic, and S for strain. Each scale is rated as 0 (normal), 1 (slight), 2 (moderate), and 3 (severe). The voices were judged by an experienced phoniatrician and voice therapist and rated in a live voice situation. Results are given as arithmetic mean values ± standard deviation;
- subjective self-assessment of voice, using the Italian translation of the Voice Handicap Index (VHI) [21], simplified for children. The VHI assesses the subject's perception of disability, handicap, and distress related to his or her voice disorders. The VHI includes 30 statements that are rated by the patient on a four-point grading scale. An experienced voice therapist read and explained the statements to children. A maximum total score of 120 corresponds with the highest grade of psychosocial impact of the voice. Results are given as arithmetic mean values ± standard deviation;
- functional evaluation: the pneumophonic coordination, the respiration during the phonation and during the rest, the general tone, the general posture, the correlated symptoms.

We studied only children visited for the first time in our department and we did not consider the children that had already received the diagnosis of dysphonia.

Results

The total number of subjects affected by dysphonia examined in the period from January 2002 to December 2006 was 1,812, of which 312 children (17.2%) aged between 2 and 16, and 1,500 adults (82.8%), as showed in Table I. In the paediatric population, 178

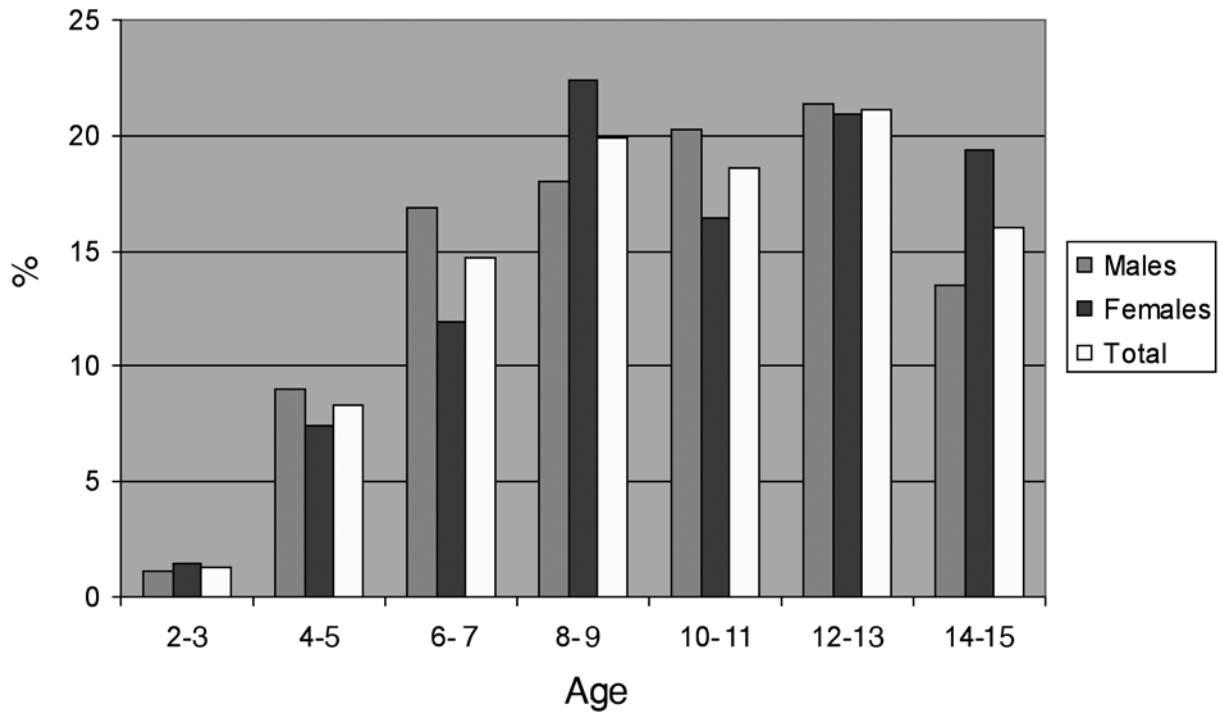
Tab. I. Gender distribution in paediatric population.

	Males		Females		Total	
	N.	%	N.	%	N.	%
Children	178	34.2	134	10.4	312	17.2
Adults	342	65.8	1,158	89.6	1,500	82.8
Total	520		1,292		1,812	

Tab. II. Age distribution in paediatric population.

	Children		Adults		Total	
	N.	%	N.	%	N.	%
Males	178	57	342	23	520	28.7
Females	134	43	1,158	77	1,292	71.3
Total	312		1,500		1,812	

Fig. 1. Age distribution in paediatric population.



Tab. III. Vocal fold alterations in paediatric population.

	N.	%
Irregularity at the junction of the anterior and middle third of the vocal folds	154	59.9
Nodules	64	24.9
Cysts	21	8.1
Edema	14	5.5
Sulcus	3	1.2
Laryngeal web	1	0.4
Total	257	

(57%) were males and 134 (43%) were females; in the adult population, 342 (23%) were males and 1,158 (77%) were females (Tab. II). The total number of male subjects affected by dysphonia was 520 (28.7%), of which 178 (34.2%) were children and 342 (65.8%) were adults (Tab. I). The total number of female subjects affected by dysphonia was 1,292, of which 134 (10.4%) were in paediatric age and 1,158 (89.6%) were in adult age (Tab. I). In the paediatric sample, the most affected age group was the one between 8 and 14 years old (Fig. 1).

In 257 children (82.4%) of children, there were present vocal fold alterations, as showed by laryngovideostroboscopic examination (Tab. III). The 90.3% of children with vocal fold alterations presented lesions (irregularity at the junction of the anterior and middle third of the vocal folds: 59.9%; nodules: 24.9%; edema 5.5%) secondary to vocal abuse and misuse and classifiable as "non-organic or functional dysphonia". Therefore, if we consider the dysphonic children without lesions to vocal folds and the dysphonic children with vocal fold lesions secondary to vocal abuse, the proportion of functional dysphonia in our paediatric sample was 92% (Tab. IV). The 65% of the examined children belonged to large families with more than two children and the 30% had

Tab. IV. Proportion of functional dysphonia and organic dysphonia in paediatric population.

Functional dysphonia			Organic dysphonia		
	N.	%		N.	%
No vocal fold lesions	55	17.6	Cysts	21	6.7
Slightly raised lesions	154	49.4	Sulcus	3	1
Nodules	64	20.5	Laryngeal web	1	0.3
Edema	14	4.5			
Total	287	92		25	8

Tab. V. Results of acoustic analysis of voice in paediatric population.

	Mean	SD
Average fundamental frequency	227.6	19
Jitter %	2.7	1.2
Shimmer%	8.1	2.6
Noise to harmonic ratio	0.18	0.06

Tab. VI. Results of GRBAS scale in paediatric population.

	Mean	SD
Grade	2.7	0.6
Roughness	0.9	0.7
Breathiness	2.2	0.6
Asthenicity	1.1	0.6
Strained	0.8	0.5

Tab. VII. Results of VHI in paediatric population.

	Mean	SD
VHI total	28.1	9.1
VHI physical	14.5	4.4
VHI functional	7.4	2.8
VHI emotional	6.2	1.9

a family history of dysphonia (brothers, parents). The study of the behavioural characteristics showed aggressive and hyperactive attitudes in 83% of the cases.
In Table V, VI and VII, we report the results of acoustic analysis of voice, GRBAS scale and VHI in paediatric population.

Discussion and conclusions

The diffusion of the dysphonia in paediatric age has steadily been increasing over the last years, as, differently from the past, more importance has been given to the voice disorders. However, there are only few data in literature about the diffusion of this disorder [6-9] and about the factors involved in its ethiopathogenesis [10-16]. Aim of our study was to quantify the number of subjects, in paediatric age, in which dysphonia was diagnosed in our department of Phoniatrics, during a period of 5 years (January 2002-December 2006). Our purpose was also to evaluate the influence of some potential risk factors (age, gender, behavioural characteristics, family unit organization, family history of the disorder). From our study it emerged that the subjects in paediatric age (aged between 2 and 16), were 17.2% of the patients affected by dysphonia (Tab. I). An interesting aspect (Tab. II) is that, in the adults, the dysphonia was more diffused in the female gender (77% of the adult patients affected by dysphonia belonged to the female gender), whilst in the paediatric age, dysphonia was more diffused in the male gender (57% of the children affected by dysphonia were males). In fact, among the dysphonic female patients, the paediatric subjects were only 10.4% (Tab. I). About the distribution in age groups in the paediatric sample, there was a neat prevalence in the age group between 8 and 14 years (59.6%) (Fig. 1). From our study, it emerged that in 82.4% of children were present vocal fold lesions as showed by laryngovideostroboscopic examination (Tab. III). The 90.3% of children with vocal fold alterations presented lesions (irregularity at the junction of the anterior and middle third of the vocal folds, nodules, edema) secondary to vocal abuse and misuse. It means that the diagnosis of dysphonia is usually made when the vocal abuse have already caused alterations to the vocal folds. From our study, it appears that the proportion of functional dysphonia in paediatric population was 92% (Tab. IV) and that important associated characteristics in dysphonic children were:

- an aggressive and hyperactive behaviour (83% of the examined children), that makes the child uses the voice as an instrument to affirm himself over the others [22];
- the belonging to large families (65% of examined child), where the child feels the need to speak loud or scream to have attention;
- family history of the disorder (30% of children had brothers or parent affected by the same disorder), that could induce in the child a mechanism of imitation.

These characteristics could be potential risk factors in the etiopathogenesis of dysphonia in paediatric age, because they contribute to determine the misuse and overuse of voice, that, in association with an incorrect phonetic attitude, determine the development of dysphonia.
If dysphonia is not promptly recognized, it could determine the appearance of alterations affecting the vocal folds, that would require rehabilitative treatment with costs for the NHS and repercussions on the child's life [23].
The results of acoustic analysis of voice and of GRBAS scale were impaired but they did not show a significative correlation with the kind of vocal fold lesions, because they were similarly impaired both in functional and organic dysphonia. Instead, by considering the results of VHI, the children affected by dysphonia were not aware of vocal disorder.
Concluding, in the ethiopathogenesis of the dysphonia in paediatric age, the vocal excessive use has a predominant role, not only as used by the child but also as used within the surrounding environment. Therefore it would be useful to promote the diffusion of informational programmes, to show the risks linked to vocal overuse in the paediatric population and also to give advice about good vocal hygiene in order to prevent the arising of dysphonia in paediatric age, although, as Segre [24] says "*dysphonic children have alterations not in vocal folds but in their souls*".

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