

Dysphonia: portrait of a population group in the city of Guarulhos

Disfonia: retrato de um grupo populacional na cidade de Guarulhos

Disfonía: retrato de un grupo de población en la ciudad de Guarulhos

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Abstract

Introduction: Dysphonia impacts in quality of life and in the labor market, being an important symptom for screening laryngeal neoplasia. **Objective:** Perform a statistical evaluation of a population group in the city of Guarulhos complaining of dysphonia. **Method:** This is a cross-sectional study using a sample corresponding to 2,564 examinations, videolaryngoscopic or nasofibrolaryngoscopic, of patients over 5 years of age, in the municipality of Guarulhos of the metropolitan region of São Paulo, by the same ENT physician and the same speech therapist, between April 2011 and April 2012. Changes in voice diagnosis were evaluated taking into account the age and gender of the patient. The sex of subjects was described according to diagnoses using absolute and relative frequencies, and the existence of an association between sex and diagnosis was verified through the use of likelihood ratio testing (Kirkwood and Sterne, 2006). Ages were described according to diagnoses using summary measurements (mean, standard deviation, median, minimum and maximum), and compared the ages between diagnoses, using variance analysis (ANOVA) followed by multiple comparisons by Tukey (Neter et al., 1996). The tests

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were performed with a significance level of 5%. **Results:** There is a higher frequency of men diagnosed with neoplasms or cancer than in other diagnoses. Of the 2,564 tests, 477 had chronic laryngitis, 69% in females; 279 functional dysphonia, 63.4% female; 137 minimal structural alterations (AEM), 69.3% female; 36 neurological dysfunctions, being equally divided between genders; and 12 presented neoplasms, 83.3% in males. **Conclusion:** There were a higher number of benign alterations in the female gender. Neoplasms and neurological dysfunctions predominated in males. Functional dysphonia and AEM occur in patients under 40 years of age, while the others occur even at advanced ages, above 50 years of age.

Keywords: Dysphonia; Voice; Larynx; Laryngoscopy.

Resumo

Introdução: A disfonia causa impacto na qualidade de vida e no mercado de trabalho, sendo sintoma importante para triagem de neoplasia laríngea. **Objetivo:** Realizar avaliação estatística de um grupo populacional da cidade de Guarulhos com queixa de disfonia. **Método:** Trata-se de um estudo transversal com utilização de amostra correspondente a 2.564 exames, videolaringoscópicos ou nasofibrolaringoscópicos, de pacientes acima de 5 anos de idade, no município de Guarulhos da região metropolitana de São Paulo, pelo mesmo médico otorrinolaringologista e pelo mesmo fonoaudiólogo, entre os meses de abril de 2011 e abril de 2012. Avaliaram-se as alterações no diagnóstico da voz, levando em consideração idade e sexo dos pacientes. Foram descritos os sexos das pessoas segundo diagnósticos com uso de frequências absolutas e relativas e verificou-se a existência de associação entre sexo e diagnóstico através do uso de teste da razão de verossimilhanças (Kirkwood e Sterne, 2006). As idades foram descritas, segundo diagnósticos, com uso de medidas resumo (média, desvio-padrão (DP), mediana, mínimo e máximo), e foram comparadas as idades entre os diagnósticos, com uso de teste análise de variâncias (ANOVA) seguido de comparações múltiplas de Tukey (Neter et al., 1996). Os testes foram realizados com nível de significância de 5%. **Resultados:** Há maior frequência de homens com diagnóstico de neoplasias ou câncer que nos demais diagnósticos. Dos 2.564 exames, 477 apresentaram laringite crônica, sendo 69% do gênero feminino; 279 disfonia funcional, 63,4% do gênero feminino; 137 alterações estruturais mínimas (AEM), 69,3% do gênero feminino; 36 disfunções neurológicas, sendo igualmente divididos entre os gêneros; e 12 apresentaram neoplasias, sendo 83,3% do masculino. **Conclusão:** Verificou-se maior número de alterações benignas no gênero feminino. Neoplasias e disfunções neurológicas predominaram no gênero masculino. A disfonia funcional e as AEM ocorrem em pacientes abaixo dos 40 anos, enquanto as demais ocorrem até em idades avançadas, acima dos 50 anos.

Palavras-chave: Disfonia; Voz; Laringe; Laringoscopia.

Resumen

Introducción: La disfonia impacta en la calidad de vida y en el mercado laboral, siendo un síntoma importante para el cribado de la neoplasia laríngea. **Objetivo:** Realizar una evaluación estadística de un grupo poblacional de la ciudad de Guarulhos que se queja de disfonia. **Método:** Se trata de un estudio transversal que utiliza una muestra correspondiente a 2564 exámenes, videolaringoscópicos o nasofibrolaringoscópicos, de pacientes mayores de 5 años, en el municipio de Guarulhos de la región metropolitana de São Paulo, realizados por el mismo otorrinolaringólogo y el mismo logopeda, entre abril de 2011 y abril de 2012. Los cambios en el diagnóstico de voz se evaluaron teniendo en cuenta la edad y el sexo de las personas. Los sexos de las personas se describieron de acuerdo con los diagnósticos utilizando frecuencias absolutas y relativas, y la existencia de una asociación entre el sexo y el diagnóstico se verificó mediante el uso de pruebas de razón de probabilidad (Kirkwood y Sterne, 2006). Las edades se describieron de acuerdo con los diagnósticos utilizando mediciones resumidas (media, desviación estándar, mediana, mínima y máxima), y se compararon las edades entre los diagnósticos, utilizando el análisis de varianza (ANOVA) seguido de comparaciones múltiples de Tukey (Neter et al., 1996). Las pruebas se realizaron con un nivel de significancia del 5%. **Resultados:** Hay una mayor frecuencia de hombres diagnosticados con neoplasias o cáncer que en otros diagnósticos. De las 2.564 pruebas, 477 presentaban laringitis crónica, el 69% en mujeres; 279 disfonía funcional, el 63,4% mujeres; 137 altera-

ciones estructurales mínimas (AEM), el 69,3% mujeres; 36 disfunciones neurológicas, estando divididas por igual entre géneros; y 12 presentaban neoplasias, el 83,3% en varones. **Conclusión:** Hubo un mayor número de alteraciones benignas en el género femenino. Las neoplasias y las disfunciones neurológicas predominaron en los varones. La disfonía funcional y la AEM ocurren en pacientes menores de 40 años de edad, mientras que las otras ocurren incluso a edades avanzadas, por encima de los 50 años de edad.

Palabras clave: Disfonía; Voz; Laringe; Laringoscopia.

Introduction

Human voice is fascinating and complex. Although the larynx has phylogenetically developed for the preservation of species, by promoting the protection of the airways against aspiration and adequate breathing, its phonatory function is not less important in the development of humankind. However, voice disorders have become increasingly frequent in a society which makes use of the power of communication. Among vocal disorders, dysphonia is the most common in the Brazilian population¹. About 25% of economically active individuals consider phonation a primordial work tool in their daily lives. This group includes teachers, among whom 80% will suffer from vocal symptoms at a certain point in their professional lives^{1,2}. Therefore, it can be said that dysphonia directly impacts the job market and quality of life.

The larynx is the essential organ for voice production and has accessory structures for vocalization, such as dorsal, abdominal, and thoracic muscles; lungs; pharynx; and oral and nasal cavities. Congenital alterations of the larynx, airway infections, allergic factors and inadequate vocal habits are some etiologies which can cause dysphonia³. The reported symptoms are the following: effort to produce voice, difficulty in maintaining voice, tiredness when speaking, variations in the usual fundamental frequency, lack of volume and projection, loss of vocal efficiency and little endurance when speaking, among others⁴. Dysphonia can be classified as organic, functional or organofunctional⁵.

Organic dysphonia is independent of vocalization and can be exemplified by laryngeal cancer, psychiatric diseases, acute and chronic laryngitis, neurological dysphonia, laryngeal papillomatosis⁵. Laryngeal neoplasia is a highly prevalent cause. Laryngeal tumors, especially associated with smoking and alcoholism, account for 2% of all types of cancer in Brazil, which correspond

to approximately 8,000 new cases per year⁶. The most common laryngeal neoplasms are squamous cell carcinomas, followed, in descending order, by adenocarcinomas and lymphomas⁷. The most common risk factor for the development of laryngeal neoplasm is tobacco use, and this risk is accentuated by excessive alcohol consumption⁸. Other risk factors include human papillomavirus infection (subtypes 16 and 18)⁹, leukoplakia, and gastroesophageal reflux disease (GERD)¹⁰. In relation to inflammatory dysphonia, inflammation is a harmful factor to the laryngeal tissue. Laryngitis can be caused by chronic or recurrent bacterial, viral, or fungal respiratory infections, as well as by tuberculosis, laryngopharyngeal reflux and/or exposure to environmental irritants or harmful agents¹¹.

Another important type of dysphonia is the neurological one, as some neurological diseases can lead to voice changes, swallowing problems, or breathing difficulties¹². Adverse consequences to neuroanatomical systems and pathways (cerebellum, extrapyramidal system, upper and lower motor neurons, neuromuscular junction, muscle unit) can compromise voice and speech production¹³. The four most common neurological causes are: vocal fold paralysis or paresis, hypokinetic dysarthria, essential tremor, and spasmodic dysphonia. The most frequently associated events include thyroidectomy, congenital malformations (Chiari malformation) and brainstem injuries³. Hypokinetic dysarthria, mostly caused by Parkinson's disease, is a degenerative movement disorder characterized by reduced levels of dopamine in the basal ganglia. Associated with the high incidence of voice and communication impairment, approximately 75% to 90% of affected people present some form of speech difficulty¹⁴. Essential tremor is an age-related movement disorder characterized by an involuntary movement tremor that affects the voice in approximately 25% to 30% of cases¹⁵. Spasmodic dysphonia is a movement disorder due to spasm

of the adductor or abductor muscles of the larynx, resulting in hoarseness¹⁶.

Functional dysphonia, on the other hand, is dependent on the use of voice, however it does not present laryngeal lesions secondary to vocalization. This variety is subdivided into: psychogenic dysphonia, in which phonation is a manifestation of psychological alterations; voice misuse dysphonia, also known as primary functional dysphonia; and vocal maladjustment, whether anatomical, due to minimal structural alterations (MSA), or functional, also called secondary functional dysphonia⁵.

Finally, organofunctional dysphonia results from cases of functional dysphonia which develop secondary lesions, such as granulomas, nodules and polyps⁵. Nodules are the main lesions responsible for dysphonia in children and adolescents, prevailing in boys under 12 years of age, and in girls from 12 years of age⁴. In relation to the adult age group, there is a higher incidence of nodules in females between 25 and 40 years of age¹⁷.

In a survey carried out in the United States, it was reported that almost 30% of the adult population had already experienced a voice disorder during their lifetime and almost 7% reported a current voice problem¹⁸. According to the Brazilian Academy of Laryngology and Voice, about 20% to 30% of Brazilians have a certain type of lesion in the vocal folds¹⁹. In the Brazilian population, dysphonia is the most common finding among the symptomatology of vocal disorders¹. In this symptomatic group, there are individuals with more serious associated diseases, who need early medical approach.

Given the aforementioned statistical impact, epidemiological studies on dysphonia become important for nosological knowledge. The association of the otorhinolaryngological diagnosis of the larynx with gender and age, in certain population groups, not only favors the understanding of how the alterations behave, but also helps in choosing intervention strategies, especially those of a preventive nature.

Guarulhos is a municipality in the metropolitan region of the city of São Paulo, Brazil. It is the second most populous city in the state of São Paulo, the 13th most populous in Brazil and the 53rd most populous in the American continent, with 1,392,121 inhabitants, according to an estimate by the Brazilian Institute of Geography and Statistics (IBGE) in July 2020²⁰. Therefore, Guarulhos presents a

great opportunity to investigate the main factors correlated with dysphonia and to start planning preventive and curative measures for its beginners.

Therefore, the present study aims to carry out a statistical evaluation of a population group with a complaint of dysphonia in the city of Guarulhos.

Methodology

This is a cross-sectional study using a sample corresponding to 2,564 videolaryngoscopy or nasofibrolaryngoscopy exams, of patients over 5 years of age, with or without medical supervision, in the municipality of Guarulhos, in the metropolitan region of the city of São Paulo, from April 2011 to April 2012.

This period was marked by two important “*Campanhas da Voz*” (Voice Campaigns), in which vocal problems were publicized in the media, and the local public health service carried out joint efforts to provide care. All individuals had different degrees of dysphonia and were previously screened by the speech-language pathology team. The patients signed the Free Will and Informed Consent Form (TCLE), agreeing with the disclosure of the study result, which was submitted to the local Research Ethics Committee (CEP) of the Health Department of Guarulhos, obtaining approval under the number 97441.

After data collection, alterations in the voice diagnosis were evaluated, considering the age and gender of the individuals. The inclusion criteria were as follows: patients over 5 years of age, with vocal complaints, using the Brazilian Unified Health System (SUS) in the municipality of Guarulhos. The exclusion criteria were as follows: patients with difficulties in participating/performing the exam or whose diagnosis was unclear during the exam.

Everyone’s gender was described according to diagnoses using absolute and relative frequencies, and the existence of an association between gender and diagnosis was verified using the likelihood ratio testing (Kirkwood and Sterne, 2006). The age was described, according to diagnoses, using summary measurements (mean, standard deviation, median, minimum, and maximum), and the ages between diagnoses were compared, using the analysis of variance test (ANOVA), followed by Tukey multiple comparisons (Neter et al., 1996). The tests were carried out with a significance level of 5%.

The exams were performed by the same ENT team (the same ENT doctor and the same speech-language pathologist) from the same service, with the capacity and training for such diagnosis, and using a specific protocol according to the exam report, always performed on the same platform.

The otorhinolaryngologist holds a master's degree in Medicine (Otorhinolaryngology) from the Medical Science School of the Santa Casa Hospital of São Paulo and a Doctorate in Medicine (Otorhinolaryngology) from the Medical Science School of the Santa Casa Hospital of São Paulo. He has 20 years of experience in laryngeal examinations. The speech-language pathologist, on the other hand, has an undergraduate degree in Speech-Language Pathology from São Camilo University Center, a master's degree in Communication Disorders from the Pontifical Catholic University of São Paulo (PUC/SP), a doctorate in Sciences - Area of Concentration: Otorhinolaryngology, from the Medical School of the University of São Paulo (FMUSP), and experience in Speech-Language Pathology, with emphasis on voice, working mainly on the following topics: clinical voice, professional voice,

oratory, vocal exercise physiology, voiced tongue vibration, vocal technique and vocal fatigue.

A specific protocol was adopted according to the report of examinations always performed on the same platform, which were carried out using a Scott LC 960 videolaryngostroboscope or a flexible nasofibrolaryngoscope Machida ENT-30PIII 3.2 mm. Both are considered efficient tools for evaluating vocal health and for screening for laryngeal neoplasms, however nasofibroscopy was used in patients with intolerance to rigid laryngoscopes. In this exam, there is a direct and clear visualization of the larynx, enabling the analysis of the entire organ. Thus, it is possible not only to assess the occurrence of benign or malignant lesions, but also to verify whether the functionality of the organs is normal or altered.

Results

Among the 2,564 patients, 1,493 (58.2%) were female and 1,071 (41.8%) were male. Age varied between 5 and 90 years ($M=33.21$; $SD\pm 21.5$).

Table 1. Description of gender and age according to diagnosis and results of statistical tests.

Variable	Diagnosis						Total	p
	Normal	Chronic laryngitis	Functional dysphonia	MSA	Neurological	Neoplasms		
Gender								<0.001*
N (%)								
Female	872 (53.7)	329 (69)	177 (63.4)	95 (69.3)	18 (50)	2 (16.7)	1,493 (58.2)	
Male	751 (46.3)	148 (31)	102 (36.6)	42 (30.7)	18 (50)	10 (83.3)	1,071 (41.8)	
Age (years)								<0.001**
mean (SD)	26.8 (19.2)	53 (14.7)	32.3 (23.3)	34.8 (17.3)	56.9 (17.1)	55.1 (18.6)	33.2 (21.5)	
median (min.; max)	17 (5; 90)	54 (7; 86)	27 (7; 88)	37 (7; 77)	62 (8; 83)	60,5 (15; 74)	29 (5; 90)	

Legend: (MSA) Minimal structural alterations; (p) percentile; (*) Result of the likelihood ratio testing; (**) ANOVA result.

Table 1 shows that there is a statistically significant association between gender and diagnoses, with a higher frequency of men diagnosed with neoplasms or cancer than with other diagnoses ($p<0.001$). Ages are, on average, statistically different between diagnoses ($p<0.001$).

Overall, 1,623 exams had normal results (good glottic closure, no clefts, good laryngeal mobility bilaterally, vocal folds with smooth and regular edges), 872 (53.7%) of which were female and

751 (46.3%) were male, with a mean age of 26.8 ($SD\pm 19.2$); 477 exams showed chronic laryngitis, 329 (69%) females and 148 (31%) males, with a mean age of 53 ($SD\pm 14.7$); 279 tests showed functional dysphonia, 177 (63.4%) females and 102 (36.6%) males, with a mean age of 32.3 ($SD\pm 23.3$). Among the functional dysphonia diagnoses, 137 exams presenting MSA were set apart, 95 (69.3%) females and 42 (30.7%) males, with a mean age of 34.8 ($SD\pm 17.3$); 36 exams showed neurological

disorders, being equally divided between genders as 18 (50%), with a mean age of 56.9 (SD±17.1); 12 exams revealed neoplasms, 2 (16.7%) females and 10 (83.3%) males, with a mean age of 55.1 (SD=15.74).

Table 2. Result of multiple comparisons of ages between diagnoses.

Comparison	Mean difference	Standard error	P	IC (95%)	
				Inferior	Superior
Normal - Chronic laryngitis	-26.20	0.98	<0.001	-28.99	-23.41
Normal - Functional dysphonia	-5.49	1.22	<0.001	-8.96	-2.01
Normal-MSA	-8.00	1.67	<0.001	-12.77	-3.23
Normal - Neurological	-30.10	3.17	<0.001	-39.13	-21.06
Normal - Neoplasms	-28.32	5.45	<0.001	-43.86	-12.78
Chronic laryngitis - Functional dysphonia	20.71	1.42	<0.001	16.67	24.76
Chronic laryngitis - MSA	18.20	1.82	<0.001	13.00	23.40
Chronic laryngitis - Neurological	-3.90	3.25	0.838	-13.17	5.37
Chronic laryngitis - Neoplasms	-2.12	5.50	0.999	-17.79	13.56
Functional dysphonia - MSA	-2.52	1.96	0.795	-8.11	3.08
Functional dysphonia - Neurological	-24.61	3.33	<0.001	-34.11	-15.11
Functional dysphonia - Neoplasms	-22.83	5.54	0.001	-38.64	-7.02
MSA - Neurological	-22.10	3.52	<0.001	-32.14	-12.05
MSA - Neoplasms	-20.32	5.66	0.005	-36.46	-4.17
Neurological - Neoplasms	1.78	6.27	>0.999	-16.10	19.65

Results of multiple comparisons by Tukey

Legend: (MSA) Minimal structural alterations; (p) percentile; (CI) Confidence intervals.

Table 2 shows that people without alterations are, on average, statistically younger than those with any diagnosis ($p<0.05$); people with chronic laryngitis have a statistically higher mean age than those with functional dysphonia and MSA ($p<0.001$); people with neurological alterations and people with neoplasms are statistically older than those with functional dysphonia and MSA ($p<0.05$).

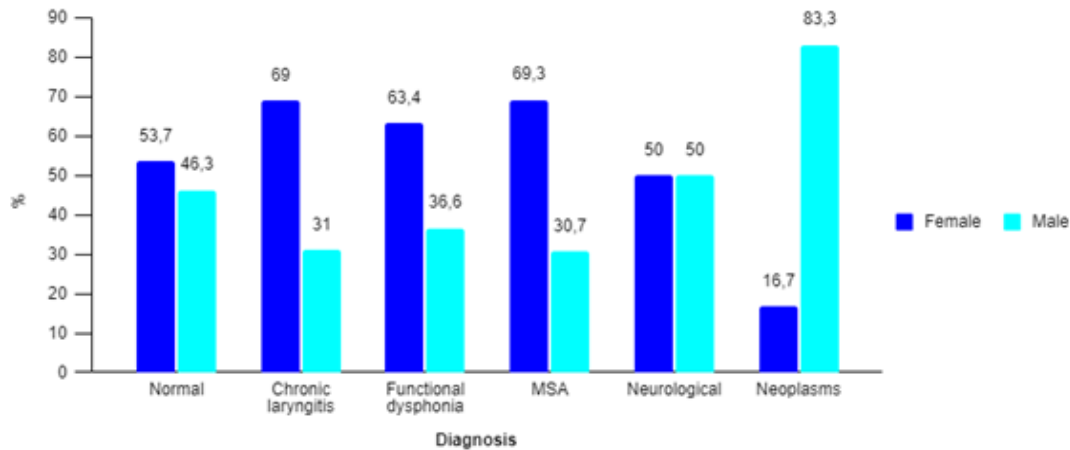
Discussion

A sample corresponding to 2,564 performed exams, via videolaryngoscopy or nasofibrolaryngoscopy, was collected from patients over 5 years of age, in the municipality of Guarulhos in the metropolitan region of the city of São Paulo, from April 2011 to April 2012, to evaluate vocal health and screen for laryngeal neoplasms. In this exam,

there is a direct and clear visualization of the larynx, allowing an evaluation of the entire organ. Thus, it is possible to verify the occurrence of benign or malignant lesions and to verify whether the functionality of the organs is normal or altered²¹.

Regarding the benign causes of dysphonia, there was a greater number of alterations in females, which is consistent with the literature³; neoplasms were more frequent in males (Graph 1), and neurological dysfunctions were equally observed in both gender groups.

It should also be taken into consideration that, in addition to the laryngeal anatomy, there was a greater number of females being tested. This may occur because there is a predominance of women in speech-language pathology consultations, as well as in the voluntary search for joint efforts. Furthermore, the number of females to seek early care is considered higher when compared to males¹.

Graph 1. Percentages of male and female for each diagnosis.

Legend: (MSA) Minimal structural alterations.

In females, the high occurrence of functional dysphonia is expected, since the anatomy, physiology, and histology of the larynx in women favor the appearance of clefts, such as the triangular cleft level 1 (posterior), which is considered physiological. However, due to misuse, the physiological cleft can evolve into a cleft prone to developing pathologies, such as vocal nodules^{17,22,23}.

Males have the anterior glottic portion larger than the posterior glottic portion, while females have a glottic ratio of 1:1. This finding results in the “increase of the opening angle of the anterior commissure” which, in turn, promotes a constant impact, generally in the middle third of the vocal folds, during phonation in women²².

Muscle tension syndrome is an association between increased tone of the laryngeal muscles, elevated larynx, and the presence of posterior cleft. This syndrome further increases the predisposition to vocal nodules which trigger incomplete glottic closure during phonation and, consequently, pathological glottic clefts^{22,24}. It is noteworthy that the size of the nodule defines the type of glottic closure, usually presenting a mid-posterior triangular cleft or a double cleft¹⁷.

The amount of hyaluronic acid and fibronectin also contributes to the formation of nodules and clefts. Females, when compared males, have a reduced concentration of hyaluronic acid in the vocal

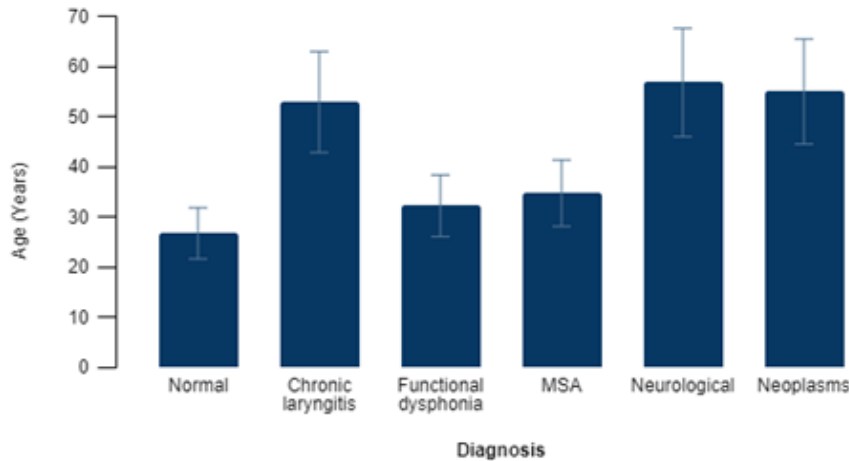
folds, causing greater friction between them during phonation. In turn, fibronectin in high concentrations in women intensifies its healing function and fiber adhesion²³.

In the MSA group, the survey also showed a higher incidence in females aged under 50 years (Graph 2). These data are also in line with the literature, as studies reveal a similar glottic configuration in adult women and children, both being susceptible to the same lesions. Furthermore, a high vocal demand in individuals between 25 and 50 years old – a life stage of heightened professional activity and productivity – also favors the clinical manifestation of MSA^{4,17,22}.

Regarding neoplasms, they are known to affect more males than females, aged over 50 years⁶, since smoking and alcoholism are more common in men than in women²⁵. It is noteworthy that smokers are 10 times more likely to develop laryngeal cancer than non-smokers and that, for people who associate smoking and alcoholism, this number rises to 43 times²⁶.

Regarding neurological diseases with laryngeal repercussions, there was no difference between genders. However, they were more frequent in the older group, which is expected due to the natural history and evolution of most neurological diseases mentioned in the study¹⁴.

Graph 2. Mean values and respective standard errors of age according to the presence of alteration in the diagnosis.



Legend: (MSA) Minimal structural alterations.

Conclusion

After analyzing 2,564 exams of individuals assisted in the “*Campanha da Voz*”, between April 2011 and April 2012, a greater number of alterations can be observed in females, except for neoplasms and neurological dysfunctions. The care given to these patients took place individually, and functional dysphonia occurs in the working-age population, while the others occur at more advanced ages, above 50 years of age.

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