




# Profile of Laryngeal Microsurgeries in Patients Over 60 Years Old

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## Abstract

**Introduction** The increase in life expectancy is an incentive to the development of researches with the elderly population aiming at actions that may ensure healthy and active aging.

**Objective** To analyze the profile of laryngeal microsurgery performed in patients > 60 years old.

**Methods** A retrospective observational study, with a cross-sectional design. A retrospective analysis of the medical records of elderly patients submitted to laryngeal microsurgery was performed at a private hospital in Curitiba, state of Paraná, Brazil, between January 2004 and December 2016. Were included all of the patients > 60 years old that underwent laryngeal microsurgery during this period.

**Results** During the studied period, 213 laryngeal microsurgeries were performed in 181 patients > 60 years old. There was a preponderance of male patients. The mean age was 67.6 years old. Squamous cell carcinoma (SCC) was the most prevalent disorder (26%), followed by Reinke edema (20%), papillomatosis (14%), polyps (11%), leukoplakia (8%), minor structural alterations (8%), associated lesions (9%), and others (4%). Men presented a higher probability of SCC diagnosis, regardless of the age group, while Reinke edema was more frequently observed in women. A directly proportional relation between the frequency of laryngeal cancer and age increase was also observed. No significant differences were observed in professional voice users.

**Conclusion** Further researches are required to properly comprehend the factors associated with laryngeal lesions and determine prevention and treatment approaches.

## Keywords

- ▶ Microsurgery
- ▶ larynx
- ▶ elderly
- ▶ squamous cell carcinoma
- ▶ reinke edema

## Introduction

Considering the increase in life expectancy, it is estimated that, in 2050, the elderly population will be of 2 billions, ~ 22% of the global population.<sup>1</sup>

It is estimated that, in 2020, Brazil will be the 6<sup>th</sup> country with the largest elderly population, of ~ 32 million people, similar values to those currently observed in developed

countries.<sup>2</sup> This panorama has encouraged the development of researches focused on this population group aiming at actions that may ensure healthy and active aging.

Roy et al<sup>3</sup> has performed an interesting epidemiological study, through electronic databases, about laryngeal disorders (surgical or not) that affected elderly patients in the United States between 2004 and 2008. They found > 60 thousand

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patients, with an average age of 75 years old. The most common disorders were hoarseness and acute laryngitis, with 44 and 21%, respectively. There are no specific data on surgical disorders. Advanced age was associated with the increase in hoarseness diagnoses and with the reduction of benign lesions. It was also observed an increase of laryngeal paresis/paralysis and reduction of Laryngeal cancer. Concerning gender, it was observed that women have less chance of presenting laryngeal cancer, paresis, and paralysis. However this group presents most of the hoarseness, acute laryngitis, and laryngospasm.

Zhukhovitskaya et al<sup>4</sup> studied the epidemiology of benign laryngeal lesions of 602 patients treated at a hospital in New York in a 5-year period. A total of 641 lesions were identified. There was a significant prevalence of nodules and pseudo-cysts in younger patients, while for the age group of > 60 years old, the most prevalent lesions, with statistical significance, were Reinke edema and leukoplakia. According to these authors, association between these disorders and advanced age can be explained by the cumulative effect of exposure to irritants.

Surgery in elderly patients requires knowledge on the alterations on the larynx due to aging. Over the years, there are alterations on the elastic and collagen fibers on the lamina propria. The thinning and mucosal atrophy and atrophy of secretory glands also occur. The disorders that usually affect this age group are: vocal fold atrophy, vocal sulcus, glottic incompetence, and vocal fold edema. Other common conditions include polyps, nodules, and Reinke edema.<sup>5</sup> There are no specific global data about laryngeal surgery in elderly patients. Therefore, the present study aims at analyzing the profile of laryngeal microsurgery on this population.

## Methods

This is a retrospective observational study, with a cross-sectional design.

The present project was approved by the Human Research Ethics Committee under the number CAAE: 73073417.8.00 00.5529.

A retrospective analysis of medical records of elderly patients submitted to laryngeal microsurgery was performed at a private hospital in the south of Brazil, between January 2004 and December 2016.

In Brazil, according to the "Statute of the Elderly" (Law 10.741/03), every person > 60 years old is considered elderly, so that was the age considered for the present study. Patients with incomplete medical records were excluded from the study. Clinical diagnosis was based on laryngoscopic examination (with stroboscopy when necessary), and confirmed by anatomopathological examination.

The results observed for age were described by mean, standard deviation (SD), median and amplitude. Percentage and frequency values were presented for categorical variables. For the comparison among age groups regarding diagnoses, the chi-squared test was used. To perform the analysis considering gender and the fact of being professional voice users, the

Fisher exact test was used. A multivariate analysis of factors related to squamous cell carcinoma (SCC) diagnosis was performed by adjusting a logistic regression model and using the Wald test. Values of  $p < 0.05$  indicated statistical significance. Data were analyzed using the software IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA).

## Results

After excluding 4 patients with incomplete medical records, the analysis presented 213 laryngeal microsurgeries performed in 181 patients > 60 years old, between January 2004 and December 2016.

### Gender

A total of 107 patients (59.1%) were male, and 74 (40.9%) were female.

### Age

Since patients submitted to > 1 microsurgery had different ages at the time of each surgery, ►Table 1 presents the descriptive statistics for age for the 213 microsurgeries.

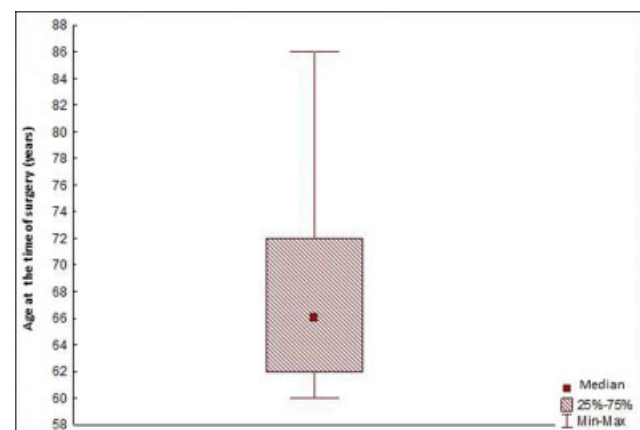
The mean age of the patients was 67.6 years old, the older with 86 years old, and the median was 66 years old. ►Graphic 1 (box plot) illustrates this variation.

Most patients (41.3%) had < 65 years old, 58 (27.2%) were aged between 65 and 69 years old, 34 (16%) between 70 and

**Table 1** Age of patients at the time of surgery, divided into age groups

| Age group (years old) at the time of surgery | n   | %    |
|--|-----|------|
| < 65   | 88  | 41.3 |
| 65 to 69                                     | 58  | 27.2 |
| 70 to 74                                     | 34  | 16.0 |
| 75 to 79                                     | 20  | 9.4  |
| ≥ 80   | 13  | 6.1  |
| Total  | 213 | 100  |

Source: the author.



**Graphic 1** Box plot with the age of patients at the time of surgery.

74 years old, 20 (9.4%) between 75 and 79 years old, and 13 (6.1%) were > 80 years old.

**Laterality**

From the 213 surgeries, 122 (57.3%) presented bilateral lesions, while 91 (42.7%) presented unilateral lesions.

**Number of Surgeries per Patient**

A total of 158 patients were submitted to a single surgery; 18 patients were submitted to 2 surgeries; 3 patients were submitted to 2 surgeries; and 2 patients were submitted to 5 surgeries.

Papillomatosis was the main cause of reoperation among the studied patients.

**Diagnoses**

► **Graphic 2** presents the percentage of diagnoses for the 213 surgeries.

Concerning the presence of isolated diseases among the 213 patients, SCC was the most prevalent condition, present in 54 patients (25.4%), followed by Reinke edema, observed in 43 patients (20.2%). Papillomatosis was the 3<sup>rd</sup> most common disease, observed in 30 patients (14.1%). Polyps were found in 23 patients (10.8%). Leukoplakias affected 17 patients (8%), as well as minor structural alterations (MSAs). Associated lesions were present in 20 patients (9.3%), and other lesions had affected 9 patients (4.2%).

Among the associated lesions are: polyp and sulcus, polyp and nodule, polyp and leukoplakia, polyp and varicosity, granuloma and contact ulcers, Reinke edema with cyst, SCC and Reinke edema, and leukoplakia with mucous cyst. Among the lesions named as “others” are: granulomas, nodules, contact ulcers, pseudocysts, dysplasia and mucous cyst.

From the 17 isolated MSAs, 15 were cysts and 2 were sulcus. Among the MSAs associated with other lesions were found: sulcus with polyp, cyst with polyp, cyst with Reinke edema, and varicosity with polyp

**Table 2** Frequency and percentages according to the diagnosis (associated or isolated)

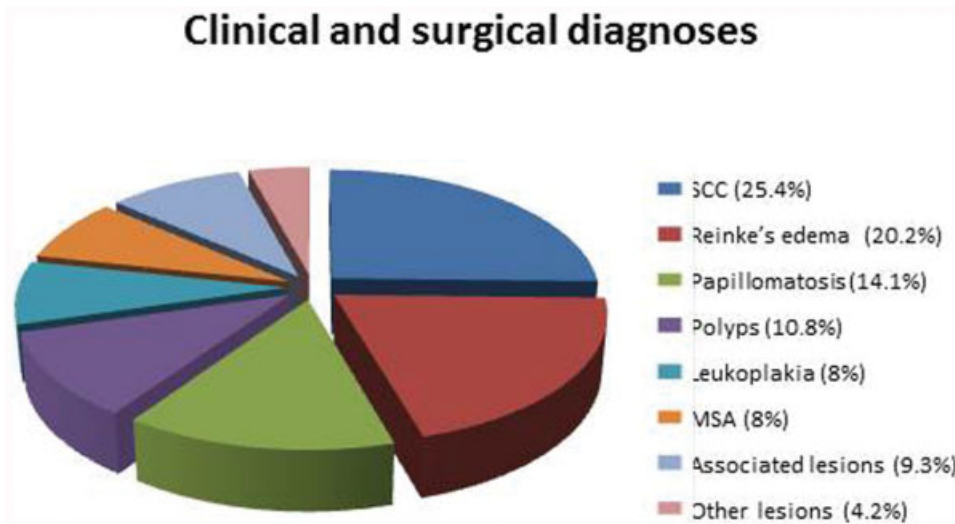
| Diagnosis               | n  | %*   |
|-------------------------|----|------|
| Squamous cell carcinoma | 56 | 26.3 |
| Reinke edema            | 51 | 23.9 |
| Polyps                  | 32 | 15.0 |
| Papillomatosis          | 30 | 14.1 |
| Leukoplakia             | 21 | 9.9  |
| Cysts                   | 20 | 9.4  |
| Granuloma               | 6  | 2.8  |
| Nodules                 | 5  | 2.3  |
| Sulcus                  | 3  | 1.4  |
| Contact ulcer           | 3  | 1.4  |
| Dysplasia               | 2  | 0.9  |
| Pseudocysts             | 1  | 0.5  |
| Varicosity              | 1  | 0.5  |

\*Percentages obtained from the total of microsurgeries (n = 213). Source: the author.

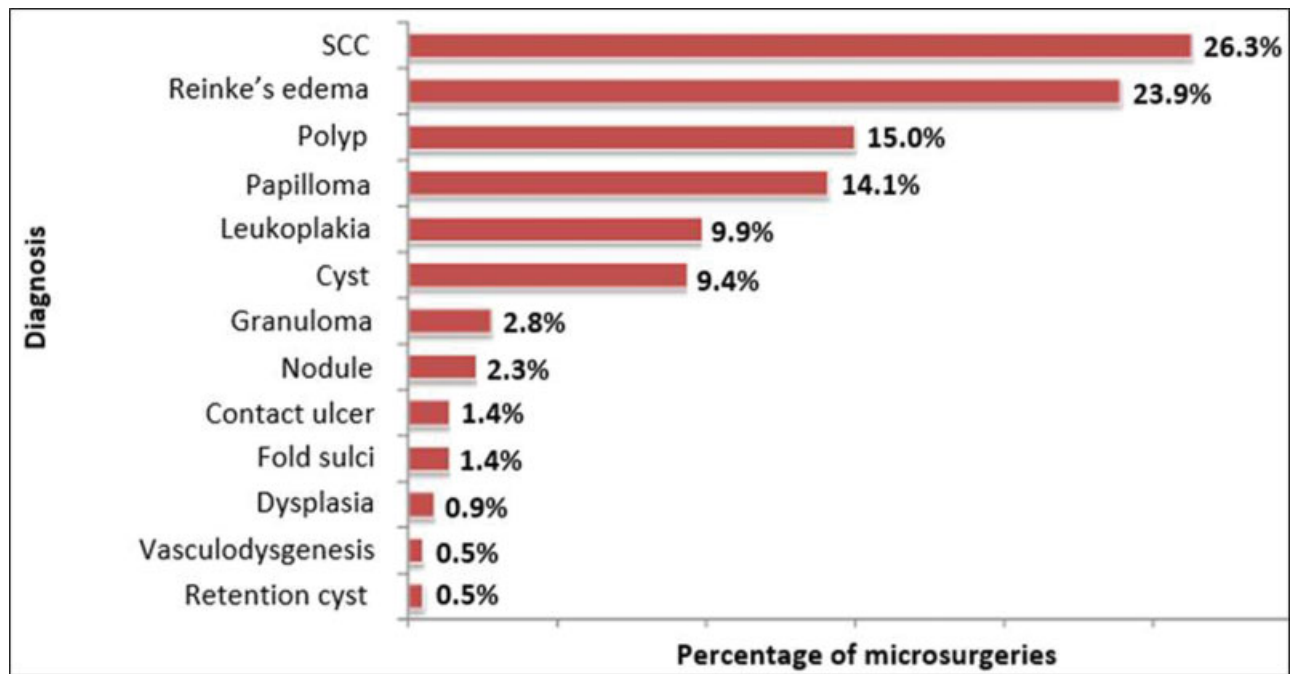
► **Table 2** shows frequency and percentages according to the diagnosis (associated or isolated).

It is important to notice that frequencies and percentages on the aforementioned table refer to each disease isolated or associated with another condition. For example, from the 56 surgeries with SCC diagnosis, 54 had isolated SCC, and 2 patients had SCC associated with another disease.

The proportion of diagnoses had alterations only for a few aspects in comparison with the surgeries of isolated diagnoses. Squamous cell carcinoma remained the most prevalent condition (26.3%), followed by Reinke edema (23.9%). This time, polyps were the 3<sup>rd</sup>, with 15% of the patients. Papillomatosis was the 4<sup>th</sup> more frequent (14.1%), while MSAs affected 11.2% of the patients, and leukoplakia, 9.9%



**Graphic 2** Clinical and surgical diagnoses of patients.



**Graphic 3** Frequency and percentages according to the diagnosis (associated or isolated).

The results from the aforementioned table are illustrated on **Graphic 3**.

#### Assessment of the Association between Age and Disorders

Since patients submitted to > 1 microsurgery had different ages at the time of each surgery, the present analysis has considered the microsurgery as a statistical unit (surgeries on the same patient were considered separately).

For each diagnostic (associated or not), the null hypothesis of equal probability of diagnostic for all age groups and the alternative hypothesis of different probabilities for all age groups were tested. **Table 3** presents frequency and percentages according to the presence or absence of the disorder and age at the time of surgery. It also presents the p-values obtained for the disorders with significant frequency for test application.

It was noticed that there was an increase on the frequency of laryngeal cancer and aging in male patients. **Graphic 4** illustrates this important association.

Considering age, 18.2% of the patients submitted to laryngeal microsurgery due to SCC were aged between 60 and 65 years old; 24.1% were aged between 65 and 69 years old, and 38.2% were between 70 and 74 years old. A total of 39.4% of the patients were > 75 years old

#### Assessment of the Association between Gender and Disorders

For this assessment, the statistical unit was the patient. Thus, the diagnoses at each surgery were considered.

For each diagnosis (associated or not) the null hypothesis of equal probability of diagnosis for both gender and the alternative hypothesis of different probabilities of diagnosis for all age groups were tested. **Table 4** shows frequency and percentages according to the presence or absence of disorder

for both genders. The p-values obtained on statistic tests and the p-values from statistics are also presented.

For SCC, significant association was observed between gender and the disorder ( $p < 0.001$ ). It was observed that 40.2% of the male patients presented SCC diagnosis versus 8.1% of the female patients. This relation is illustrated on **Graphic 5**.

The opposite occurs with Reinke edema, as illustrated on **Graphic 6**: 54.1% of the female patients were affected by this disorder versus 9.5% of the male patients.

No significant differences between genders were observed for the other studied disorders. All p-values were > 0.05.

#### Assessment of the Association between Being a Professional Voice User and Disorders

This assessment has considered the patient as a single unit. Therefore, it also considered the diagnostic at each surgery.

For each diagnostic (isolated or associated with other disorders) the null hypothesis (equal probability of diagnostic for all age groups) and the alternative hypothesis (different probabilities of diagnostic for professional voice users and other patients) were tested. **Table 3** presents frequency and percentages according to the presence or absence of disorder and age at the time of surgery. It also presents the p-values obtained for disorders with significant frequency for test application. A total of 28 patients were not included because their records did not show any information about being or not professional voice users.

No significant differences were observed between professional voice users and other patients. All p-values were > 0.05.

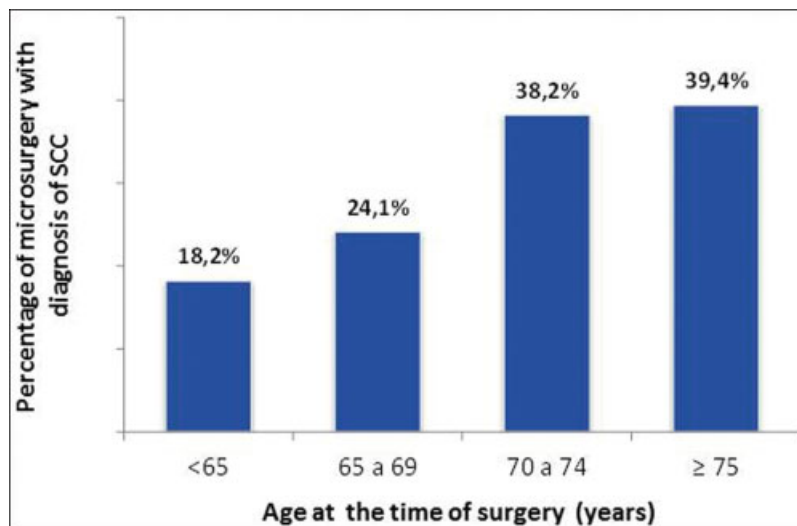
#### Multivariate Statistical Analysis of Factors Associated with Squamous Cell Carcinoma

As presented above, the analysis has found significant differences among age groups and between genders regarding the

**Table 3** Frequency and percentages according to the presence or absence of disorders and age at the time of surgery

| Variable                | Classification | Age group at the time of surgery (years old) |                      |                      |                  | p-value* |
|-------------------------|----------------|--|----------------------|----------------------|------------------|----------|
|                         |                | < 65<br>(n = 88)                             | 65 to 69<br>(n = 53) | 70 to 74<br>(n = 30) | ≥ 75<br>(n = 31) |          |
| Squamous cell carcinoma | Yes            | 16 (18.2)                                    | 14 (24.1)            | 13 (38.2)            | 13 (39.4)        | 0.036    |
|                         | No             | 72 (81.8)                                    | 44 (75.9)            | 21 (61.8)            | 20 (60.6)        |          |
| Reinke edema            | Yes            | 28 (31.8)                                    | 13 (22.4)            | 6 (17.7)             | 4 (12.1)         | 0.096    |
|                         | No             | 60 (68.2)                                    | 45 (77.6)            | 28 (82.4)            | 29 (87.9)        |          |
| Polyp                   | Yes            | 16 (18.2)                                    | 8 (13.8)             | 6 (17.7)             | 2 (6.1)          | 0.389    |
|                         | No             | 72 (81.8)                                    | 50 (86.2)            | 28 (82.4)            | 31 (93.9)        |          |
| Papillomatosis          | Yes            | 11 (12.5)                                    | 9 (15.5)             | 2 (5.9)              | 8 (24.2)         | 0.173    |
|                         | No             | 77 (87.5)                                    | 49 (84.5)            | 32 (94.1)            | 25 (75.8)        |          |
| Leukoplakia             | Yes            | 9 (10.2)                                     | 6 (10.3)             | 3 (8.8)              | 3 (9.1)          | 0.993    |
|                         | No             | 79 (89.8)                                    | 52 (89.7)            | 31 (91.2)            | 30 (90.9)        |          |
| Cyst                    | Yes            | 7 (8)  | 7 (12.1)             | 5 (14.7)             | 1 (3)            | 0.334    |
|                         | No             | 81 (92.1)                                    | 51 (87.9)            | 29 (85.3)            | 32 (97)          |          |
| Granuloma               | Yes            | 1 (1.1)                                      | 2 (3.5)              | 1 (2.9)              | 2 (6.1)          | -        |
|                         | No             | 87 (98.9)                                    | 56 (96.6)            | 33 (97.1)            | 31 (93.9)        |          |
| Nodule                  | Yes            | 3 (3.4)                                      | 1 (1.7)              | 1 (2.9)              | 0 (0)            | -        |
|                         | No             | 85 (96.6)                                    | 57 (98.3)            | 33 (97.1)            | 33 (100)         |          |
| Contact ulcer           | Yes            | 0 (0)  | 0 (0)                | 1 (2.9)              | 2 (6.1)          | -        |
|                         | No             | 88 (100)                                     | 58 (100)             | 33 (97.1)            | 31 (93.9)        |          |
| Sulcus                  | Yes            | 1 (1.1)                                      | 2 (3.5)              | 0 (0)                | 0 (0)            | -        |
|                         | No             | 87 (98.9)                                    | 56 (96.6)            | 34 (100)             | 33 (100)         |          |
| Dysplasia               | Yes            | 1 (1.1)                                      | 1 (1.7)              | 0 (0)                | 0 (0)            | -        |
|                         | No             | 87 (98.9)                                    | 57 (98.3)            | 34 (100)             | 33 (100)         |          |
| Varicosity              | Yes            | 1 (1.1)                                      | 0 (0)                | 0 (0)                | 0 (0)            | -        |
|                         | No             | 87 (98.9)                                    | 58 (100)             | 34 (100)             | 33 (100)         |          |
| Pseudocyst              | Yes            | 1 (1.1)                                      | 0 (0)                | 0 (0)                | 0 (0)            | -        |
|                         | No             | 87 (98.9)                                    | 58 (100)             | 34 (100)             | 33 (100)         |          |

\*Chi-squared test,  $p < 0.05$ .  
Source: the author.



**Graphic 4** Percentage of patients submitted to laryngeal microsurgery due to SCC, according to age.

**Table 4** Frequency and percentages according to the presence or absence of disorder for both genders

| Disorder                | Classification | Gender         |                 | p-value* |
|-------------------------|----------------|----------------|-----------------|----------|
|                         |                | Male (n = 107) | Female (n = 74) |          |
| Squamous cell carcinoma | Yes            | 43 (40.2)      | 6 (8.1)         | < 0.001  |
|                         | No             | 64 (59.8)      | 68 (91.9)       |          |
| Leukoplakia             | Yes            | 94 (87.9)      | 71 (96)         | 0.067    |
|                         | No             | 13 (12.2)      | 3 (4.1)         |          |
| Polyp                   | Yes            | 18 (16.8)      | 13 (17.6)       | 1        |
|                         | No             | 89 (83.2)      | 61 (82.4)       |          |
| Nodule                  | Yes            | 3 (2.8)        | 2 (2.7)         | 1        |
|                         | No             | 104 (97.2)     | 72 (97.3)       |          |
| Reinke edema            | Yes            | 10 (9.4)       | 40 (54.1)       | < 0.001  |
|                         | No             | 97 (90.7)      | 34 (46.0)       |          |
| Papilloma               | Yes            | 12 (11.2)      | 5 (6.8)         | 0.438    |
|                         | No             | 95 (88.8)      | 69 (93.2)       |          |
| Granuloma               | Yes            | 4 (3.7)        | 2 (2.7)         | 1        |
|                         | No             | 103 (96.3)     | 72 (97.3)       |          |
| Contact ulcer           | Yes            | 3 (2.8)        | 0 (0)           | 0.271    |
|                         | No             | 104 (97.2)     | 74 (100)        |          |
| Retencion Cyst          | Yes            | 1 (0.9)        | 0 (0)           | 1        |
|                         | No             | 106 (99.1)     | 74 (100)        |          |
| Cyst                    | Yes            | 11 (10.3)      | 9 (12.2)        | 0.810    |
|                         | No             | 96 (89.7)      | 65 (87.8)       |          |
| Sulcus                  | Yes            | 3 (2.8)        | 0 (0)           | 0.271    |
|                         | No             | 104 (97.2)     | 74 (100)        |          |
| Varicosity              | Yes            | 1 (0.9)        | 0 (0)           | 1        |
|                         | No             | 106 (99.1)     | 74 (100)        |          |
| Dysplasia               | Yes            | 1 (0.9)        | 1 (1.4)         | 1        |
|                         | No             | 106 (99.1)     | 73 (98.7)       |          |

\*Fisher exact test,  $p < 0.05$ .

Source: the author.

presence of SCC ( $p = 0.036$  and  $p < 0.001$ , respectively). To evaluate the interaction of age, gender and probability of presenting SCC, a logistic regression model was adjusted for a yes/no outcome, including age group and gender as explanatory variables. The null hypothesis of equal probabilities of presenting SCC for both genders was tested against the alternative hypothesis of different probabilities. For age group, the first range was considered, which was  $< 65$  years old. Then, for each of the other ranges, the null hypothesis was tested – regardless of gender, the probabilities of presenting SCC would be the same for the first range and the analyzed range – against the alternative hypothesis of different probabilities.

– **Table 5** shows the p-values from statistic tests and estimates values for odds ratio (OR) with confidence intervals (CIs) of 95%.

For this analysis, the diagnoses of 181 patients were considered (the patient was the statistical unit)

Patients with  $> 1$  surgery were considered as SCC carriers when the disorder was diagnosed in at least one of the

surgeries. The first age group was considered, or the first range to present an SCC diagnosis.

The result of the adjusted model indicates that, regardless of the age group, male patients present a higher probability of presenting an SCC diagnosis. Regardless of the gender, the age group analysis showed significant differences between the ranges  $< 65$  years old and  $\geq 75$  years old for SCC diagnosis ( $p = 0.033$ ). There was no significant difference between the groups  $< 65$  years old and between 65 and 69 years old ( $p = 0.671$ ), and there is a tendency to significance in the comparison between the groups  $< 65$  years old and between 70 and 74 years old ( $p = 0.071$ ).

#### Descriptive Statistics for Papilloma Recurrence

Half of the 16 patients with papillomatosis did not present any recurrence during the study period; 3 patients had one recurrence, 2 patients had 2 recurrences, and 1 patient underwent 4 laryngeal microsurgeries due to this condition.

#### Adjuvant Radiotherapy in Squamous Cell Carcinoma Patients

In 22 (39.3%) from the 56 microsurgeries with SCC diagnosis, the patients underwent complementary adjuvant radiotherapy.

#### Discussion

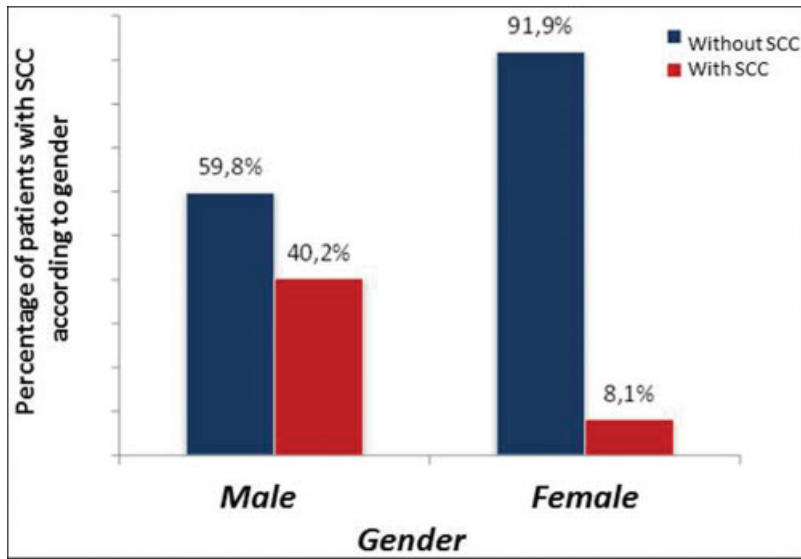
Aging is an important aspect for the development of a vocal disorder, generating high health costs related to dysphonia.<sup>6</sup> Lack of epidemiological data makes it hard to accurately identify population risks, outline causes and consequences of laryngeal disorders, establish monitoring protocols, estimate social costs related to the disorder and plan healthcare resources for the prevention and treatment of vocal disorders.<sup>7</sup>

The present study provides data to enhance the comprehension about the profile of laryngeal microsurgeries in patients  $> 60$  years old, using the data of 213 laryngeal microsurgeries performed in 181 patients  $> 60$  years old during the studied period.

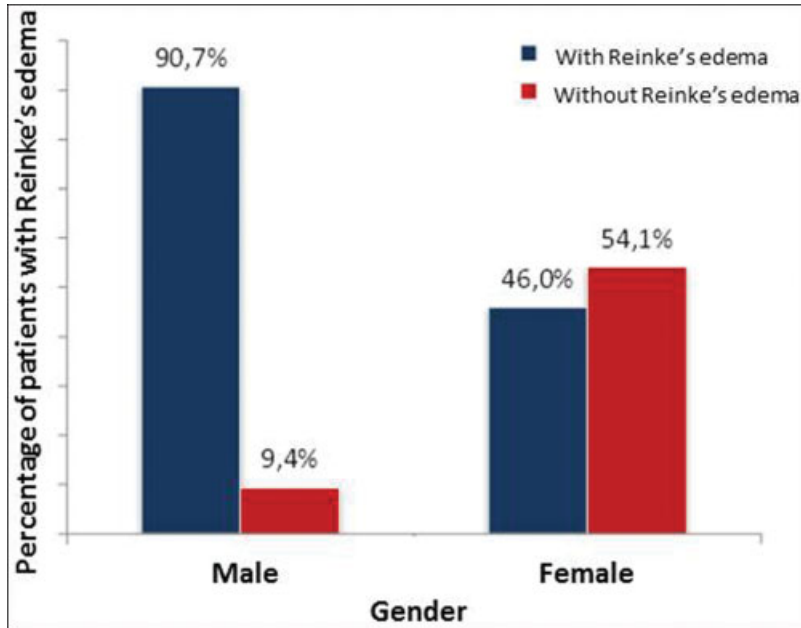
Regarding gender, there was a predominance of male patients. In the literature, however, there is the premise that women are more susceptible to vocal disorders due to structural and functional differences, especially related to traumatic vocal lesions. In an American epidemiological study with the elderly population performed by Roy et al.,<sup>3</sup> women were more affected than men, corresponding to 57% of the cases. Woo et al.,<sup>7</sup> in a large epidemiological study in South Korea, have observed that gender was not significant to the prevalence of laryngeal disorders among the general population.

The mean age of patients was 67.6 years old, with a maximum of 86 years old and a median of 66 years old. Most of the patients were  $< 65$  years old. This is the primary reason we have maintained this age cutoff, in addition to being the age at which patients are considered elderly in Brazil.

In the American study, with data on all dysphonic elderly patients regardless if it was a clinical or surgical condition, the mean age was 74.9 years old, observing that developed countries consider as elderly individuals  $> 65$  years old.<sup>3</sup>



**Graphic 5** Percentage of patients with SCC according to gender.



**Graphic 6** Percentage of patients with Reinke's edema, according to gender.

**Table 5** p values from statistic tests and estimates values for odds ratio with confidence intervals of 95%, according to the gender of the patients

| Variable              | Classification     | % of SCC cases | p-value* | OR   | 95%CI     |
|-----------------------|--------------------|----------------|----------|------|-----------|
| Gender                | Female (reference) | 8.1%           | < 0.001  | 7.32 | 2.86–18.7 |
|                       | Male               | 91.9%          |          |      |           |
| Age group (years old) | < 65 (reference)   | 18.2%          |          |      |           |
|                       | 65 to 69           | 24.1%          | 0.671    | 1.22 | 0.48–3.07 |
|                       | 70 to 74           | 38.2%          | 0.071    | 2.61 | 0.92–7.43 |
|                       | ≥75                | 39.4%          | 0.033    | 3.01 | 1.09–8.34 |

Abbreviations: CI, confidence interval; OR, odds ratio; SCC, squamous cell carcinoma

\*Logistic regression model and Wald test,  $p < 0.05$ .

Source: the author.

Most patients have presented bilateral lesions at the time of the surgery, due to the pathogenesis, caused by distinct pathogenesis or due to contralateral reaction.

Among the studied diagnoses, squamous cell carcinoma was the most prevalent, corresponding to 26% of the cases, followed by Reinke edema (20%). Papillomatosis was the 3<sup>rd</sup> most common, with 14%; polyps represented 11% of the cases. Leukoplakia affected 8% of the patients as MSAs. Associated lesions were present in 9% of the cases, and other lesions affected 4% of the cases. The comparison between these data and the current literature is hard, since there are no similar studies, considering exclusively surgical alterations on the larynx in elderly patients.

From the 17 isolated MSAs, 15 were cysts and 2 were sulcus. A Brazilian study performed with the general population, considering only benign lesions among MSAs, a higher prevalence of cysts (24%) was observed, followed by vocal fold sulcus (10%), and varicosity (4%).<sup>8</sup>

It was observed that surgery for phonotraumatic lesions in older patients is uncommon, and it may be related to newer voice use/therapy recommendations. Regarding presbylarynx or vocal atrophy, this diagnosis was not reported in the present study, because in our service, all cases are initially treated with speech therapy, with good evolution or loss to follow-up, and during this period there were no surgical procedures for this disease.

It was also noticed that, in male patients, there was an increase in the frequency of laryngeal cancer and aging. Global data show that the incidence of head and neck cancer increases with age. In Europe, 98% of these patients are > 40 years old, and only 4 to 6% are younger individuals.<sup>9</sup>

A significant association was found between male gender and SCC. Among male patients, 40% presented SCC, versus 8% of females.

The fact of cancer being the most prevalent diagnosis shows that measures for an early diagnosis are required, as well as the importance of raising awareness about dysphonia in the elderly, the most frequent symptom, as well as about other symptoms such as odynophagia, dyspnea and weight loss.<sup>10</sup>

Laryngeal cancer is a severe problem in world public health care, being the most common type of cancer to affect the head and the neck. It is responsible for 25% of the malignant tumors that affect this region, and for 2% when considering all malignant disorders. It is much more frequent in male individuals, and 85% of laryngectomized patients a proportion close to 7:1. Laryngeal cancer prevention programs have given great emphasis to educational measures, especially to the fight against smoking. However, many individuals continue to adopt bad habits.<sup>11-13</sup>

Besides smoking, alcohol consumption is also a well-established risk factor of head and neck cancer. Isolated, these factors may increase from two to three times the risk of developing laryngeal cancer. In regard to the oral cavity and the larynx the risk increases over 15 times when alcohol consumption and smoking are associated.<sup>14</sup> Although male patients are more affected, a remarkable increase on its incidence in female patients has been observed, which may reflect the increase of smoking and drinking habits among this group.<sup>15</sup>

The opposite was observed for Reinke edema. It affected 54% of the female patients versus 9% of the male patients. This disorder develops mainly in chronic smokers, most commonly affecting women, which remains unexplained. According to some authors, this fact is related to the concern of women about hoarseness – their voice becomes deeper, and may be considered as a male voice.<sup>6,16,17</sup> No significant differences between genders were observed for other disorders.

For all of the studied disorders, there was no significant difference between professional voice users and other patients. In this group of patients, dysphonia has a greater negative impact on their sense of well-being, ability of work, and even on their self-esteem.<sup>18,19</sup>

In regard to papillomatosis, half of the patients presented from one to four recurrences. Adult-onset laryngeal papillomatosis affects individuals with a higher number of sexual partners and more frequent orogenital contact. The hypothesis of orogenital transmission is based on the fact that laryngeal papillomatosis and genital warts present the same HPV of the associated infections type 6 and 11–type 6 being the most common. The epithelial transition area, from cuboidal and columnar cells, in the larynx, as well as in the uterine cervix may favor the occurrence of HPV; due to this similarity, the laryngeal epithelium can be more susceptible to infections than the oral epithelium.<sup>20,21</sup>

Regarding the diagnosis, videolaryngoscopy is one of the initial exams for patients who search for an otolaryngologist with the complaint of vocal disorders. A videostroboscopy can be performed when necessary to refine or even change the diagnosis.<sup>13</sup> Currently, the elected surgical treatment for most of the mentioned disorders is laryngeal microsurgery, either using laser or cold instruments. In our services, papillomatosis cases were treated with routine intralesional cidofovir. For granulomas, there was the possibility of using dexamethasone, associated or not with unilateral application of botulinum toxin in the thyroarytenoid muscle.

It is important to observe that the present study has its limitations. First, since the study is retrospective in nature, it has its inherent associated weaknesses. Second, certain variables that could broaden our discussions, such as the description of tumor staging, occupational history, presence of comorbidities, specially related to drinking and smoking habits, were not available. Knowledge of these last variables would be interesting due to the great proportion of patients with SCC and Reinke edema, diseases closely related to alcohol consumption and smoking, even with dose-response relationship.

Besides that, there can also be a selection bias, since the patients evaluated by the otolaryngologists may represent a healthier subgroup among the elderly population.

After these analyses, it was concluded that, despite its limitations, this was a relevant epidemiological study, since it contributes with the literature with new findings about epidemiology in the elderly population.

## Conclusions

The present research represents an important epidemiological study related to the population > 60 years old. Squamous cell



carcinoma was the most prevalent disorder, indicating that measures for an early diagnosis are required. In regard to gender, it was noticed that male patients have a higher probability of an SSC diagnosis, while Reinke edema was more frequent in female patients. In male patients, a directly proportional relation between the frequency of laryngeal cancer and age increase was verified. On the other hand, surgery for phonotraumatic lesions in older patients is uncommon and has implications related to newer voice use/therapy recommendations. For all of the studied conditions, there was no significant difference between professional voice users and other patients. In light of a rapid growth of the elderly population, further researches are required to properly comprehend the factors associated with laryngeal lesions and determine prevention and treatment approaches.

#### Conflicts of Interests

The authors have no conflicts of interests to declare.

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