

Profile of Patients with Stroke and Disorders of the Vocal Tract

Lina Claudia Pereira Lopes¹, Daniel Almeida da Costa², Marcus Vinicius de Mello Pinto^{3,4}, Aline Ronis Sampaio⁴, Lamara Laguardia Valente Rocha⁵, Isabela Nardoni Bernardes^{1,2}, Rafael Batista Ferreira^{1,2}, Elias Sobreira Sathler^{1,2}, Richard Raphael Borges Tavares Vieira^{1,2}

¹Luiz Gioseffi Jannuzzi School Hospital of the Dom André Arcoverde Foundation, Valença, Brazil

²The Medical School at the Center of Higher Education of Valença, Valença, Brazil

³University of Business and Social Sciences, Buenos Aires, Argentina

⁴The Cellulare Institute Center of Laser Treatment and Cell Therapy, Petrópolis, Brazil

⁵The Medical School at the Health Sciences Institute of the University Center of Caratinga, Caratinga, Brazil

Email: linalopes217@gmail.com, acosttta@icloud.com, orofacial_1@hotmail.com, alronis@ig.com.br,

lamara.laguardia@gmail.com, belinhax@hotmail.com, rbf_br@hotmail.com, essathler@hotmail.com, rrbtv@hotmail.com

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Abstract

Background: The present work aims to characterize the profile of patients with stroke treat at a hospital located in the Region of the Mata of Minas Gerais, Brazil, considering the findings of the clinical vocal tract, kind of stroke, age and gender of such patients. **Methodology:** To obtain data, the clinical profile of 133 patients with a clinical or tomography diagnosis of stroke was analyzed, and the results were presented in percentage. For quantitative data average and analysis the tests were done with associations that held χ^2 test, and for significance it was considered $p < 0.05$. **Results:** From the total of patients, 63 were women, accounting for 47.4% and the other 52.6% were males. Clinically, they were characterized with the highest percentage for ischemic stroke (89.4%) compared to the hemorrhagic type (10.6%). Most of them were referred for computed tomography (86.5%) and remained hospitalized for an average of 6.496 ± 7.372 days. Similar percentages were obtained in the analysis of the population in question, when considering if they had (54.1%) or not (49.6%) any damage in their speech, language skills or swallowing. There were different types of disabilities in patients with stroke. Men with an average age of 69.8 ± 13.9 presents mostly ischemic stroke, and the majority of patients with stroke had hemiplegia and abnormalities of the vocal tract, dysphasia, and aphasia. While older patients had an ischemic stroke and were presented with left hemiplegia, the younger ones suffered from hemorrhagic strokes that caused a disability characterized as right hemiplegic. **Conclusion:** Our results show important conclusions regarding the clinical evolution of the vocal tract of patients who suffered strokes during the period of the analysis, being useful

for better comprehension of how the vocal tract from these patients evolved according to the kind of stroke, sex and age also allowing a contraposition with other future statistics periods available in literature. It can also be pointed out the difficulties in diagnosing the stroke and the concern with the immediate care, but not with its continuance or with its multidisciplinary approach, giving an evident life risk through dysphasia and the increase of permanent damage when there isn't an appropriate work done with the patients.

Keywords

Speech Disorders, Swallowing Disorders, Stroke, Vocal Tract

1. Introduction

Language is an important cognitive function presented in human beings and it can be defined in three different ways, and all of them translate the complexity of this function. As described by Pereira *et al.* (2003), it is a series of steps in an extremely complex manner in which the individual, by storing, combining symbols and expressions would be capable of communicating [1]. For Marchesan (2005), language is a common phenomenon in human beings from every society and possesses very similar construction mechanisms. It is frequently interpreted as inseparable from thinking, but actually thinking can happen without it; language is taught and the capacity to learn is innate [2].

For the realization of speech and language, several processes are involved in the cerebral cortex. Thus, distinct alterations in the Central Nervous System result in different disturbances of communication. Among these alterations, the main are aphasia, dysarthrias and apraxia [3] [4] [5].

With Wernicke and Broca's contribution, aphasia started being considered as a disturbance of memory, and a language disorder, distinguishing itself commonly into two types: sensorial aphasia and motor aphasia [4].

In more recent works, aphasia can be defined as alterations in the process of language, being related not only to many mechanisms associated to speech, but also to the process involved in interpretation of this language, and it would be caused by lesions acquired in the central nervous system, arising from strokes, traumas or tumors [5].

Speech therapy works with the subdivisions of aphasia considering location, size of the lesion and the symptomatology that is given from works developed by different researchers. Thus, starting from studies of Paul Broca and Carl Wernicke performed in aphasic individuals after death, language functions were attributed to cerebral hemispheres. This way, Broca suggested that the capacity of speech would be located in the ventral posterior region of the frontal lobe. Therefore, lesions in the left frontal lobe in a region named Broca's area affect the capacity to produce efficient language, being this way named motor or expressive aphasia, or Broca's aphasia. According to Wernicke, an area on the left

temporal lobe would be responsible for comprehending the spoken language. That way, the lesions in a region also named Wernicke's area would be responsible for a disorder known as sensorial or receptive aphasia, or Wernicke's aphasia [6] [7].

Regarding the signs and symptoms presented by aphasic individuals, it is observed that in sensorial aphasia there is a loss in the comprehension of language, being kept the capacity of articulated language. In motor aphasia, the individual loses the capacity of speech, but keeping the understanding of what it is spoken [8].

The recovery from aphasia can be defined in relation to time, in acute phase (related to the neurobiology of the lesion) and the long-term phase (where it a continuous recovery occurs) [9]. Thus, the recovery of this lesion happens through the phenomenon of neuroplasticity that can be defined as the capacity of the nervous system to alter its function or structure in response to the influences of the environment [3].

The number of aphasics in the USA is about one million people. Approximately one in five (1:5) of the 400 thousand people in the USA that had suffered from infarcts every year become aphasic. One in every three victims of severe cranial lesions is aphasic [10].

In Brazil there is slim data available on the profile of aphasics treated in rehabilitation centers. In a study by Mansur (2002), a descriptive work was done in 192 patients of a Unity attached to the Neurology Division of the Medical School Hospital of the University of São Paulo collecting demographic data, etiology, language assessment, and studies and results of neuroimaging showing that (52%) were men and (48%) women. The incidence 70% of aphasia, 6% of dysarthria and apraxia, 17% of functional alterations in communication and 7% were normal in this study [11].

Dysarthria is a disorder where there are changes in the control of muscles that are responsible for speech productions, generated by lesions in the Peripheral or Central Nervous System. Infectious, metabolically and toxic diseases or cerebral strokes can be its origin [12]. It can be classified as flaccid, spastic, of the upper unilateral motor neuron, hypokinetic, hyperkinetic, ataxic and mixed. In their study, Ribeiro & Ortiz (2009) concluded that, in relation to the population profile of dysarthric patients, attended in a tertiary hospital, a bigger prevalence was observed in males, especially between 20 and 50 years old. The most common types of dysarthrias were the flaccid and of the upper unilateral motor neuron. The prevalent etiology for this disturbance of speech was the stroke [12]. Apraxia is the incapacity of making a movement or a sequence of movements [5]. Another speech disorder existed is the verbal dyspraxia or development apraxia. This disorder is characterized by the general motor orofacial difficulties, inability to imitate sounds, mistakes on a sequence of sounds, vocal alteration, difficulties with natural speech movements, and sound omissions among other changes [13].

Swallowing consists in a dynamic process done by a set of mechanisms coor-

minated by the cerebral cortex, brainstem and encephalic nerves. Swallowing disorders are characterized by alterations in this function, due to neurological damage, mechanical or psychogenic, characterizing dysphagia [2] [3] [6] [9].

Dysphagia is one of the main causes of risk factors for aspiration pneumonia, one of the most frequent complications of a stroke and Brazil's main death cause. Its incidence is rate is about 50% in patients who have suffered a stroke [14]. Besides that, dysphagia is related to the morbidity and mortality increase after a stroke [15].

According to Kurnst *et al.* (2012), the cerebral lesions that originate aphasias can be caused by exogenous factors, like traumatic brain injury or infectious diseases, and by endogenous factors, like strokes or tumors. The stroke happens when there is a sudden interruption of the blood flow to a part of the brain, known as an ischemic stroke, or when there is a rupture of a blood vessel, known as a hemorrhagic stroke [16].

Considering the epidemiologic profile of a stroke, it is known that the occurrence risk doubles every decade after 55 years old, having the hemiparesis as a significant deficit due to the lesion [17]. It also constitutes as one of the main death causes in developed countries, being the third death cause in the USA. The relative risk of men/women suffering a stroke is of 1.25 (for ages between 55 - 44 years), 1.5 (for ages between 65 - 74 years), 1.7 (for ages between 75 - 84 years) and 0.76 (for age's superior to 85 years). The increasing of age is also related to this risk, because about 3/4 of every stroke happens after 65 years. Data from the National Institute of Neurological Disorders and Stroke (NINDS) also reveals a relation between the risk of a stroke and skin color, because of a superior incidence on black people when compared with white people, and also, 87% of the strokes are ischemic, 10% are intercerebral hemorrhage and 3% are subarachnoid hemorrhage [18].

The data of incidence of aphasia after a stroke differs from author to author, thus, according to the Boston Diagnostic Aphasia Examination (BDAAE), the Boston Naming Test (BNT) and the Token Test, from the 192 evaluated patients, 70% were aphasic, 17% presented functional alterations in communication and 7% were normal. In other study, developed by Arruda, Reis and Fonseca (2014) that evaluated 31 patients hospitalized for having had a stroke, most of them was aphasic, which are 90% comprehension aphasia and 60% expression aphasia [19]. Other authors claim that 1/3 of the patients that survives the first week after strokes are aphasic [20].

According to the reviewed data disturbance of speech and language, and dysphagia, had a high prevalence among patients who had suffered from a stroke, and are main causes of morbidity and mortality in Brazil and in the world. The correct referral of these patients is essential to guarantee a quicker recovery with smaller sequels. Through this perspective, it is important to obtain more knowledge over the multidisciplinary work involved on these patients' treatment, as actions that seek their care and monitoring. Thus, the present study intended to characterize the epidemiological profile of patients who had had strokes at the

Public Health Care System of Brazil and treated at a hospital located in the Region of the Mata of Minas Gerais, Brazil.

2. Methodology

This study is characterized as a cross-sectional quantitative research done between January and December of 2009, from secondary data obtained in a philanthropic House of Charity of Muriaé of Hospital of São Paulo, located in the Region of the Mata of Minas Gerais, Brazil.

To obtain data, the clinical profile of 133 patients with a clinical or tomography diagnosis of stroke was analyzed, and the results were presented in percentage. These patients were treated at this hospital by Public Health Care System of Brazil also had the diagnosis confirmed by neurologists. As a principle of inclusion, were considered patients with confirmed diagnosis for strokes that developed some kind of language or swallowing disorder. Were excluded from this study, patients who had history of brain tumors, head traumas or mental disorders.

Data was obtained through secondary sources, that is, medical reports where information regarding age and gender was sought. In the determination of the clinical profile of these patients it was considered the period of internment, the realization of a tomography, speech therapy and types of disorders reported by the multidisciplinary team and contained in the medical records.

For the characterization of the sample, percentage tables were used for qualitative data. For the quantitative results, analysis of variance and average tests were used. In parametric data these tests were conducted through the t test. In non-parametric data the same tests were done through the Mann-Whitney Rank Sum Test. The average results were presented in graphics. In the analysis of associations an χ^2 test was conducted and the results were presented in double entry contingency tables. For the significance, $p < 0.05$ was considered.

3. Results

To obtain data, 113 patients diagnosed with strokes were surveyed. From these patients 63 were women, corresponding 47.7% of the total researched patients and the other 52.6% corresponds to the male gender. Related to age, the average was of 69.8 \pm 13.9, being the minimum age equal to 33 years old and the maximum 94 years old.

Clinically the stroke of these patients was predominantly of the ischemic type (89.4%) when compared to the hemorrhagic type (10.6%). Most of them were sent to perform computed tomography (86.5%) and remained hospitalized for an average time of 6.5 \pm 7.4 days.

Similar perceptual was obtained in the analysis of the population in question, when having disability was considered (54.1%) or not being informed (49.6%). Different kinds of disability were found in patients who suffered from strokes and the results can be found registered on **Figure 1**.

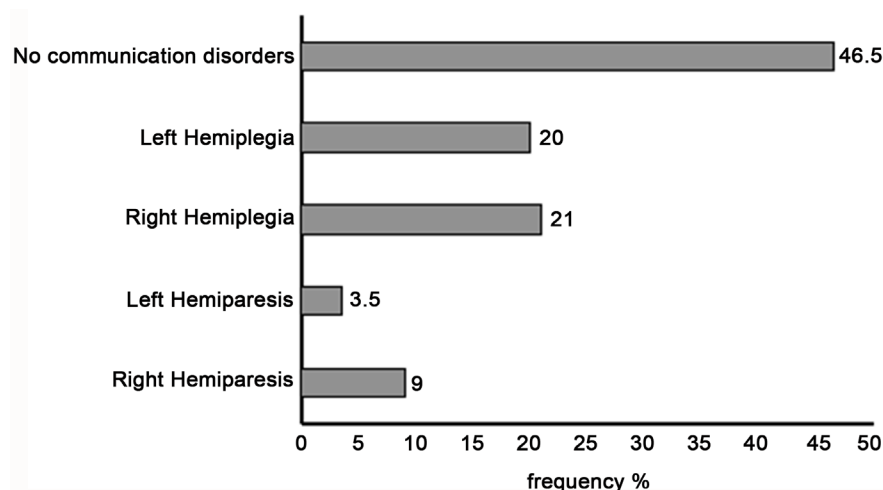


Figure 1. Graphic about the percentual of patients and the kinds of disability after the stroke (n: 133).

Though 46.5% of the patients didn't inform about having any disability, 53.4% of them were identified as having some kind of disability, and the most relevant percentages were those of right (21%) or left (20%) hemiplegia, followed by right (9%) and left (3.5%) hemiparesis (**Figure 1**). In relation to the findings on the vocal tract, different kinds of disorders that affect communication or swallowing were found. The data can be found on **Figure 2**.

The assessment that presented (50%) or not (50%) alterations in the vocal tract show similar percentages in our sample. Among the individuals affected with some kind of disorder in speech or swallowing, the highest percentages are those of aphasia (22%) and dysphasia (14.4%) and 6.8% presented some kind of difficulty in language/speech or disarthria (**Figure 2**). Most of the patients (78.2%) with or without speech disorders, were not sent to speech therapy.

The division of patients with ischemic or hemorrhagic strokes in groups according to age was observed different age averages, in which patients with the ischemic type (70 +/- 13.88) presented significantly more advanced age than that of the group with the hemorrhagic type (62.14 +/- 11.33), as observed on **Figure 3**.

In **Figure 4**, the sample was divided in groups according to the type of disorder and the average age of each group was determined.

While evaluating the age average and the kind of disability, it was observed that in the sample, individuals with higher age were in the group of people who suffered from hemiplegia (71.0 +/- 13.5) when compared to the group of hemiparesis (62.01 +/- 15.3). Part of the sample fits in the group in which this information was not described, and this group (70.6 +/- 13.4) also presented higher age than those diagnosed with hemiparesis.

Possible relations between age, gender and clinical data were stipulated and can be shown on **Tables 1-3**.

In the association between gender and a disability post-stroke classified as left and right hemiplegia, it was observed a significant relation between these va-

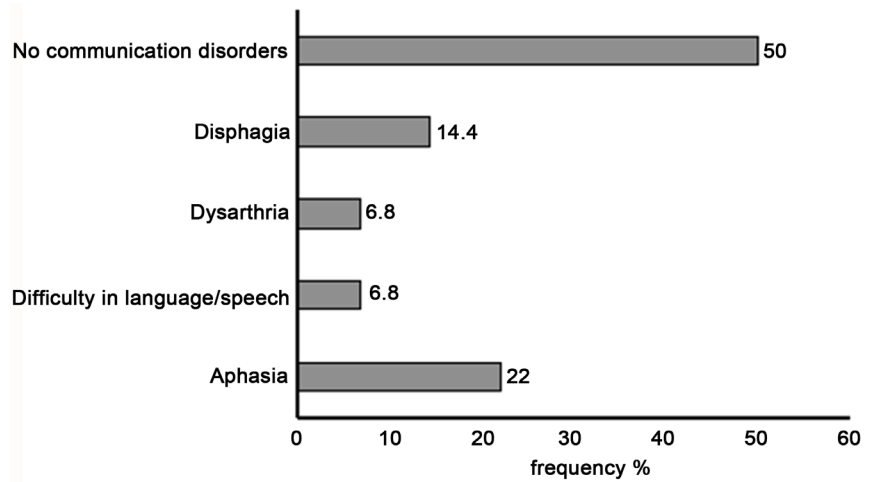


Figure 2. Graphic about the percentage of patients and findings in the vocal tract.

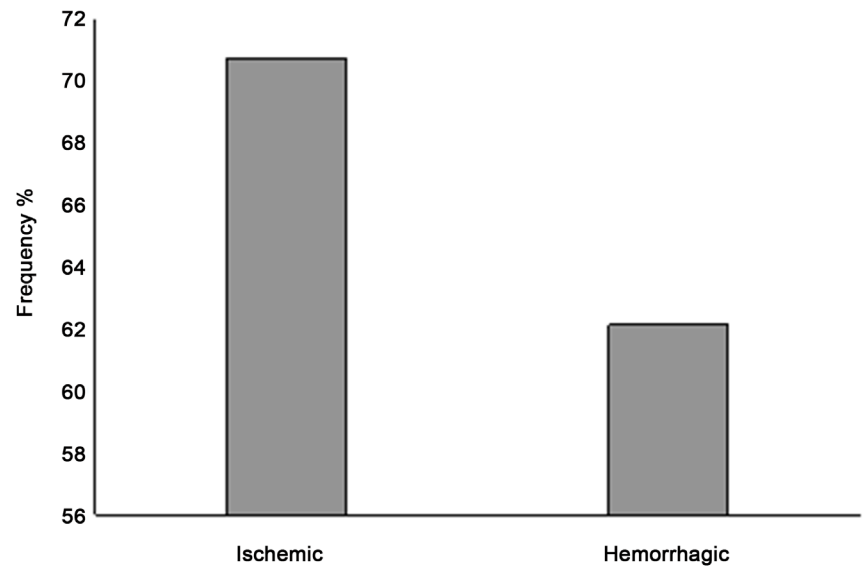


Figure 3. Graphic about the percentual of the type of stroke found according to the age group (n: 133). *Significantly difference between Ischemic and Hemorrhagic ($p = 0.00729$ for Mann-Whitney Test).

Table 1. Association between left and right hemiplegia with gender considering all kinds of findings in the vocal tract of patients with stroke seen at a House of Charity of Muriaé, Brazil (n = 133).

	Women	Men	χ^2	Freedom degree	<i>p</i>
Left Hemiplegia	13	21	4.47	1	0.0345
Right Hemiplegia	15	6			

Bold significant difference by chi-square test.

Table 2. Association between gender and stroke types.

Cerebrovascular accident	Woman	Men	χ^2	Freedom degree	<i>p</i>
Ischemic	53	50	5.56	1	0.0184
Hemorrhagic	1	10			

Bold significant difference by chi-square test.

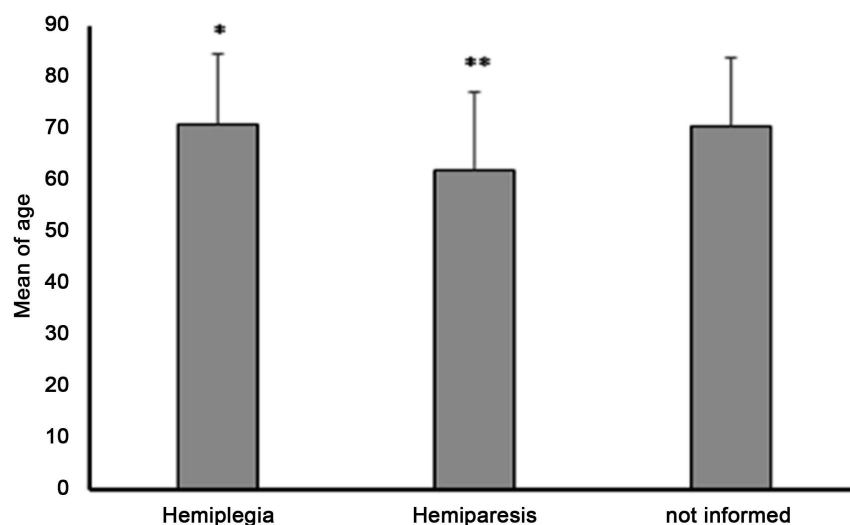


Figure 4. Graphic about the age of the patients and the kind of disorder developed after the stroke (n: 133). * $P = 0.025$ for Hemiplegia \times Hemiparesis (Test t); ** $P = 0.042$ for Hemiparesis and not informed (Mann-Whitney Test).

Table 3. Association between right or left hemiplegia and the type of stroke.

Cerebrovascular accident	Right Hemiplegia	Left Hemiplegia	χ^2	Freedom degree	P
Hemorrhagic	20	4	8.01	1	0.0046
Ischemic	13	18			

Bold significant difference by chi-square test.

riables, where the left hemiplegia occurs in a bigger number of men and the right hemiplegia in a bigger number of women.

It was also observed a higher significance in the relation between gender and the type of stroke, ischemic or hemorrhagic, where a bigger number of women had an ischemic stroke, while men suffered more from the hemorrhagic type.

In the association between the types of hemiplegia and the types of stroke, it was also observed a significant relation between these variables, occurring a higher number of right hemiplegia in strokes of the hemorrhagic kind, and a higher occurrence of left hemiplegia in ischemic strokes.

4. Discussion

The 133 patients that suffered strokes and consequent disorders in the vocal tract, attended at a hospital located in the Region of the Mata of Minas Gerais, Brazil in the period from January to December, 2009, were characterized predominantly as men, with an average age of 69 ± 13.9 years old. There was a predominance of the ischemic type of stroke with hemiplegia as the most frequent kind of disability. Aphasia and dysphagia were the main findings on the vocal tract of these patients. Older individuals presented mainly the ischemic type of stroke and hemiplegia. Among men, the most frequent type of stroke was the hemorrhagic type with hemiplegia. Among women though, the most fre-

quent kind of stroke was the ischemic type, determining right hemiplegia. It was also registered a bigger occurrence of left hemiplegia in the hemorrhagic stroke, and right hemiplegia in the ischemic type.

The predominance of male individuals in samples of patients who suffered from strokes found in this study is according to what authors like Mazzola *et al.* (2007), and Pereira *et al.* (2009), described [21] [22].

Pereira *et al.* (2009) justifies this finding related to gender, contrasting with the age factor. Thus, it is considered that men around the age of 70 years present higher risk of strokes when compared to women of the same age. This risk only increases in women after 85 years old, possibly due to hormonal alterations related to the lipid profile and obesity worsening in this age group. The sample analyzed in this study is composed predominantly by men at the age of 69, thus, at higher risk conditions of strokes than the women in the studied population, which is consistent with what Pereira *et al.* (2009) proposed [22].

Other studies also discuss the relation between age and stroke risk, and consider 70 years the age with the highest stroke risk. That way, Zukerman *et al.* (2010), connects the deaths by stroke to socioeconomic factors, happening predominantly in low-income countries with higher incidence of people with less than 70 years [23].

In 1999 the deaths by stroke in Portugal happened mainly in the population group with minimum age of 35 years and maximum of 70 years [24]. In the studies of Mazzola *et al.* (2007), though, the minimum and maximum age varied between 50 and 69 years. These findings differ from those of this study, where the results varied between 33 and 94 years old. These differences in the results can be related to more than just socioeconomic factors, but also to cultural factors like eating habits [21].

Regarding the predominance of the ischemic stroke over the hemorrhagic type discussed in the results, it is coherent with what other authors affirmed, as described by Paulo *et al.* (2009), who confirms the ischemic type as the most common [25]. This predominance of the ischemic type of stroke is also confirmed by Mazzola *et al.* (2007) [21].

Regarding the average time of hospitalization, it was identified varying times among the studies. Thus, Mazzola *et al.* (2007) affirms that the population afflicted by strokes in their sample was hospitalized for about 12.4 days [21]. In the study developed by Paulo *et al.* (2009), this average value is of 16.8 days [25]. Our studies point towards a lower time of hospitalization average values than the ones aforementioned, which can be related to the type of health care, for it is known that the hospitalizations conducted by Public Health Care System of Brazil are carried out in smaller periods due to the bigger necessity of rotation as a result of the small number of beds when compared to the demand of the service.

Considering the occurrence of disorders post-stroke, some authors describe that most of the patients developed disabilities after a stroke, which is in accordance with the findings presented on this paper [26] [27] [28]. However, our study does not accord to the study of Mazzola *et al.* (2007) who found out a

much higher percentage of patients without post-stroke disorders. On his discussion, this author supposes that his findings, despite in discordance of what is described in literature, should be related to the bad lifestyle of the researched population that led to the precocity of this hemodynamic disorder in younger patients [21].

As for the disorders found in this research, hemiplegia corresponds to the highest percentage found, which is also in accordance with the study of Mazzola *et al.* (2007), that also registers a higher occurrence of aphasia and dysphagia [21].

These findings are also in agreement with Tallarico *et al.* (2010), who arrived at the conclusion that aphasia was the most frequent language disorder between the total cases surveyed [5]. Mansur *et al.* (2002) related that 70% of the researched patients developed aphasia [11]. As for dysphagia, in the study of Schelp *et al.* (2004), 76.5% of the patients developed post-stroke dysphagia, according to the clinical evaluation of speech therapy [14].

In this study, an association between gender and the type of stroke was presented, in which the ischemic type was most frequent on women and the hemorrhagic type on men. This gender relation and the kind of stroke can be comprehended if what Mazzola *et al.* (2007) stated about possible risk factors for the development of this hemodynamic event is taken into account. He describes how risk factors, like systemic arterial hypertension, cardiac diseases, sedentary lifestyle, alcohol consumption, smoking and diabetes promote strokes. It is known that men are not as careful with their health as women, what could favor uncontrolled blood pressure, creating a higher occurrence of hemorrhagic stroke on men [21].

Pires *et al.* (2004), working with patients who suffered from strokes attended at Santa Casa de São Paulo, evaluated the main risk factors and concluded that around men, the alcohol consumption and smoking habits were more frequent. Thus, it is discussed the influence of these habits in the elevation of the systemic blood pressure. Regarding the lipid profile of the sampled population, older women presented increased rates for Low Density Lipoproteins, which could favor atherosclerosis [29]. Considering this data, it is possible to comprehend the results exposed in this study that show that hemorrhagic strokes are more frequent in men and ischemic in women.

Furthermore, the relation between older ages and higher incidence of ischemic strokes here shown, can also be comprehended through the findings of Pires *et al.* (2004), who affirms that metabolic alterations, mainly those related to the lipid profile may predispose the older population of men and women to ischemic strokes [29].

The right hemiplegia happened in higher proportions on hemorrhagic strokes, and the left hemiplegia on ischemic strokes. In a study involving patients affected by it in a hospital in Natal, Rio Grande do Norte, Brazil, conducted by Costa, Silva and Rocha (2009) shows that there was a prevalence of the ischemic type of stroke, where most of them resulted in lesions on the right cerebral he-

misphere and a predominance of the hemiplegia ipsilateral over the manual right motor dominance [18]. In other works it is possible to observe a higher prevalence of lesions on the left cerebral hemisphere [30] [31] [32]. The higher incidence of the ischemic type of stroke that acts predominantly on the left cerebral hemisphere could explain the higher occurrence of right hemiplegia found in our data, as much as in the association of these parameters with gender or not.

5. Conclusions

The present study conducted at a House of Charity of Muriaé, Brazil that surveyed 133 patients who suffered from strokes, registers the following results as epidemiologic profile of this sample: men with an average age of 69.8 +/- 13.9 presented higher incidence of ischemic stroke; most of the patients that suffered from strokes presented hemiplegia, and aphasia and dysphagia as vocal tract disorders. Older patients presented the ischemic type and hemiplegia. The younger patients presented the hemorrhagic type and the disability were provoked by the right hemiplegia.

In this research it is perceived the relevance of the epidemiological survey of patients affected by strokes, considering primarily the diagnosis difficulties and the decrease in the life quality of patients who suffered from language and speech disorders, besides the large life risk proportioned by the dysphagia.

It is recommended multidisciplinary interventions from professionals like doctors, nurses, physiotherapists, speech therapists and others, who participate in actions regarding the quick and effective diagnosis, to try to identify the kind of disability and disorders, including those of the vocal tract, in order to improve the life quality and the recovery of the patient.

Our results show important conclusions regarding the clinical evolution of the vocal tract of patients who suffered strokes during the period of the analysis, being useful for better comprehension of how the vocal tract from these patients evolved according to the kind of stroke, sex and age also allowing a contraposition with other future statistics periods available in literature.

We verified difficulties in the diagnosis of the stroke and the continuity of multidisciplinary long-term care, primary for a good prognostic, and it shows the necessity of creating strategies to minimize the imminent death risk. Also, these strategies must approach the primary attention plan with focus on prevention of strokes.

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