



## Research Article

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# Stroke - TIA Patient's Profile: A Wide Analysis of 157 Cases

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## Abstract

**Background:** Stroke is one of the main causes of death in the world and it still being the disease that most leaves sequels. So, understanding the profile of the patient who suffers a neurological ischemic event is crucial for all healthcare professionals, specially neurologists and neurosurgeons.

**Methods:** Observational, descriptive and analytical article, where patients were blindly analyzed. Summaries of hospitalization from patients who suffered an ischemic stroke or a transient ischemic attack were analyzed.

**Results:** 157 patients were analyzed. The average age was 66,3 years old. 61% were man and 39% women. Most important risk factor: Hypertension being in 85% of them. Most important Toast: Cardioembolic being in 39% of the cases. Previous stroke in 23% and TIA occurred in 27%. Injury topography: 83% anterior circulation; 9% posterior; 8% both. Carotid atheromatosis in 42% of the cases.

**Conclusion:** Analyzing the patients, many characteristics showed high prevalence. Complementary exams must be requested. Hypertension and diabetes are the most important risk factors. There is a significant TIA rate. Each Toast present particular risk factors that has major influence on each of them, as well as specific characteristics.

**Keywords:** Ischemic stroke; Transient ischemic attack; Toast; Epidemiology; Risk factors

## Introduction

There are 5 etiologies or Toasts for an ischemic stroke: Microangiopathy (when small vessels of the brain undergo ischemia); Great Vessels Disease (on wich a great vessel is occluded by an atheroma plaque); Other Causes; Cryptogenic and Cardioembolic (when an embolus originated by the heart goes to a brain vessel, impairing area irrigation) [1-5]. The Toast classification was first described by Adams et al. [5] and ever since the classification was maintained. In this article we used their classification as the foundation for stratifying our patients and to determine the Toasts [5]. Cardioembolic Toast usually represents more serious ischemic strokes, once they are more likely to occlude large vessels, leading to greater areas of brain ischemia. This kind of stroke is caused by cardiac alterations, such as: atrial fibrillation, valve defects, ventricular thrombus, atheroma in the aortic arch, congenital heart defects and myocardial acute infarct [1].

The atherosclerotic injuries of great vessels can be classified into four different clinical scenarios: according to the presence or absence of ischemia symptoms on the extracranial part of carotid artery, presence of atherosclerosis in intracranial arterial segments and atherosclerotic disease in the extracranial part of the vertebral artery [2].

Approximately 30% of ischemic strokes are considered cryptogenic. However, there are many causes not well known and explored by the physicians, such as: Fabry Disease, CADASIL, Mitochondrial encephalomyopathy, Moyamoya disease, among others [6]. Moyamoya disease is a progressive occlusive vasculopathy that results in stenosis or occlusion of distal internal carotid artery or proximal part of its branches, with later abnormal vascular weave formation [3,4].

Systemic arterial hypertension; smoking; etilism; diabetes mellitus; dyslipidemias; chronic atrial fibrillation; cardiopathies and Chagas disease, are classical risk factors that are able to illustrate how different can be the profile and the background of an ischemic stroke patient. The stroke itself is an important risk factor for its recidivism [2,4, 7-11]. TIA is a clinical syndrome characterized for a sudden onset of a neurologic deficit that was originated for any impairment in brain vascular weave and doesn't leave alterations on imaging exams made after the event and usually lasts less than 24 hours. An analysis of cardiovascular system must be done to identify a possible cause of TIA, like atrial fibrillation. Treatments are responsible for a 80% risk reduction for ischemic stroke occurrence [12,13].

There are many findings related to arteries and heart that influence prevention, treatment, post-hospital conduct, but mainly the identification of stroke's Toast, such as aorta ectasia, left atrial dilatation, left ventricle dysfunction, valves diseases and atheroma plaques in carotid artery and its branches, vasculopathies, coagulopathies, patent foramen ovale (PFO), paroxysmal atrial-fibrillation (PAF), many times not recognized on a simple EKG, valvular heart-disease, atrial septal aneurysm (ASA) and a left atrial appendage thrombus (LAAT) [14]. LAAT are usually associated with atrial fibrillation and cause systemic thromboembolism complications [15]. ASA has a prevalence of 2% to 9% and it's related to PFO in 60% of the patients [16]. In most cases patients with a PFO don't manifest any symptoms. However, when there is a clot in the blood or just the alteration of the blood flux a stroke is a real concern [11,17].

The occlusion of a specific artery in the encephalon will characterize the topography of the stroke. These occlusion will cause hypoxia and deterioration of the area irrigated by an artery and the area will not be able to exercise its function anymore, what leads to the symptoms onset. The stroke topography is divided in: anterior circulation, when the occlusion is at a carotid branche or the carotid artery itself or posterior circulation, referring to the vertebral artery and its branches. Some arteries are frequent places of occlusion, what explains the most important symptoms of the illness. The anterior circulation is the most affected, especially the middle brain artery, therefore it must be always focus of investigation in the exams [9,18,10,19].

Stroke is notably more recurrent in elderly people, most cases occur after 60 years old and after each decade the risk of stroke increases significantly [9,4,10]. Stroke is one of the main death causes in the world, also in Brazil and still being the disease that most leaves sequels [20].

## Methods

This is an observational and analytical study, that patients were blindly analyzed. The summaries of hospitalization from patients who underwent monitoring in cerebrovascular disease ambulatory and suffered an acute ischemic event (ischemic stroke or transient ischemic attack), in the period from December 2015

to December 2017, at a tertiary Hospital in the city of Campinas (São Paulo) were analyzed. Data about age, risk factors, Toast, TIA occurring, previous strokes, injuries topography and comorbidities were analyzed. To determine the ischemic event mechanism subtype, patients underwent electrocardiography, extracranial and intracranial Doppler ultrasound, transthoracic echocardiography, and at least one brain CT scan. In selected cases, transesophageal echocardiography, 24-hour Holter monitoring, CT angiography or digital angiography were also performed. All the absolute frequencies were calculated among the total cohort and the relative frequencies were obtained by diving the absolute frequencies by the total cohort. The data analyzed were compared with bibliography review. Due to retrospective design of this study, we did not apply for ethics committee approval. We guarantee that no patient were submitted to any process due to this study. We also realized a heterogenous literature review using articles from many different countries, specially from Brazil, once our patients were from this country. We used also data from books and guidelines, once the ischemic stroke is a consecrated disease with some absolute truths. Regarding the articles used we only used articles published in English available in PUBMED between 2000 and 2018. The review part of the article wasn't applied for ethics committee approval due to the retrospective design of this literature review.

## Results

This study includes data of 157 patients, in the above-mentioned characteristics. The avarege age of the analyzed patients was of 66,3 years old. Mens represent 61% of the patients and women 39%.

### Risk factors

**Table 1:** Risk factors occurrence in patiens who presented an ischemic event.

Risk Factor	Absolute Frequency	Relative Frequency
Hypertension	134	85%
Diabetes Mellitus	50	32%
Smoke	49	31,00%
Previous TIA	42	27%
Previous Ischemic Stroke	35	22%
Ethilism	34	21,00%
Cardiopathy	31	20,00%
Dyslipidemia	26	16,50%
Atrial Fbrillation	24	15,00%
Hypothyroidism	16	10,00%
Previous Heart Attack	8	5,00%
Chronic Renal Insufficiency	7	4,00%
Chagas Disease	3	2,00%
Previous Lung Complications	3	2,00%
Femur Fracture	2	1,00%

HIV+	2	1,00%
Moyamoya Disease	2	1%
Drug Addiction	2	1%
Self Medication	1	1%
Previous Hemorrhagic Stroke	1	1%
Patent Foramen Ovale	1	1%
Hyperthyroidism	1	1%

Among risk factors, hypertension was the most important being present in 85% of the patients; followed by diabetes present in 32% of them, smoking in 31%, previous ischemic stroke in 22%,

ethilism in 21%, cardiopathy in 20%, dyslipidemia in 16% and atrial fibrillation in 15%. The data about the risk factors are available in Table 1.

### Toast

About the stroke etiology or Toast, draws the attention that 39% of it were cardioembolic, 18% due to great vessels disease (atherosclerosis), 18% due to microangiopathy, 23% were cryptogenic and 2% were due to other causes (1% due to carotid dissection and 1% due to moyamoya disease). The diabetes mellitus, ex and current smokers, dyslipidemia, atrial fibrillation, previous ischemic stroke, TIA, hypothyroidism and the posterior circulation strokes occurrence, were compared with the stroke's Toast in Table 2.

**Table 2:** Diabetes mellitus, ex and current smokers, dyslipidemia, atrial fibrillation, previous ischemic stroke, TIA, hypothyroidism and the posterior circulation strokes occurrence compared with stroke's Toast.

	Cardioembolic (N = 61)	Great Vessels (N = 28)	Microangiopathy (N = 28)	other Causes (N = 3)	Cryptogenic (N = 37)
Diabetes Melitus (N = 50)	16	9	13	1	11
Ex/Current Smokers (N = 49)	15	13	7	2	12
Tia Occurrence (N = 42)	11	4	4	1	22
Previous Ischemic Stroke (N = 35)	15	7	4	2	7
Dyslipidemia (N = 26)	10	4	5	1	6
Atrial Fibrillation (N = 24)	21	0	2	0	1
Hypothyroidism (N = 16)	4	4	3	0	5
Posterior Circulation (N = 26)	6	6	12	1	1

### Topography

Looking to the ischemic stroke topography 83% of them had only anterior circulation impairment, 9% only posterior impairment and 8% had both.

### Complementary exams

On the complementary exams recurrent comorbidities were found, such as carotid atheromatose in 42% of the cases, mitral insufficiency in 25%, left ventricle dilatation in 19%, left ventricle hypertrophy in 18% of them among other findings that can be seen in Table 3.

**Table 3:** Complementary Exams Findings.

Recurrent Comorbidities in Exams	Absolute Frequency	Relative Frequency
Carotid Atheromatosis	66	42,00%
Mitral Insufficiency	39	25,00%
Left Ventricular Dysfunctions	30	19%
Left Ventricular Hypertrophy	29	18,00%
Aortic Insufficiency	23	15%
Atrial Enlargement	23	15,00%
Aortic Ectasia	21	13%
Gyrus and Sulcus Atrophy	14	9,00%
Pulmonary Hypertension	10	6,00%
Intracranial Aneurysms	8	5,00%
Aortic Atheromatosis	8	5,00%

### TIA cases

TIA occurred in 27% of our patients. 90% of those patients presented hypertension, 36% diabetes mellitus, 21% cardiopathy, 19% were ex or current smokers, the others risk factors are presented in Table 4. 95% of this population suffered an anterior circulation TIA, 2% posterior circulation and 2% committed both circulations. Among the 157 patients analyzed who presented an ischemic event (ischemic stroke or TIA), 2 of them presented Moyamoya Disease, both patients presented a TIA and not an ischemic stroke. This relation is available at Table 5.

**Table 4:** Risk factors of TIA patients.

Tia Patients (N = 42)		
Risk Factor	Absolute Frequency	Relative Frequency
Hypertension	38	90%
Diabetes Mellitus	15	36%
Cardiopathy	9	21%
Smokers	8	19%
Hypothyroidism	5	12%
Dyslipidemia	5	12%
Atrial Fibrillation	3	7%
Moyamoya Disease	2	5%

**Table 5:** Moyamoya Disease occurrence.

Moyamoya Disease Occurrence	
Stroke Patients	Tia Patients
0	2

## Discussion

### Hypertension

Chaves et al. [21] and Ovbiagele et al. [7] showed that the hypertension is the most important risk factor for ischemic stroke [7,4,21-23]. 40% to 50% of the ischemic strokes are caused by hypertension in U.S.A [7]. Boehme et al. [4] reported that the proportion of strokes in the population attributable to hypertension is approximately 54%. Yao et al. [22] after analyze 858 patients who suffered an ischemic stroke and 844 health patients matching with the gender and age of ischemic stroke patients in the same period, reported that the incidence of ischemic stroke in hypertensive population was 62.6%. Among the ischemic stroke patients group 69% of them presented hypertension [22]. Lange et al. [23] after analyzing 359 patients that suffered their first ischemic stroke episode reported that 82,1% of them had hypertension [23]. In this study 85% of the selected patients suffer from this illness, being in that way the most important risk factor of our cohort, what corroborates the literature findings.

### Atrial fibrillation

The patients with atrial fibrillation have 5 times more chance to suffer an ischemic stroke [24]. The atrial fibrillation is the cause of 15% to 20% of the strokes [25]. In this study 15% of the patients analyzed have intermittent or permanent atrial fibrillation. In Brazil it can be seen similar examples, where 16,7% of the the patients that suffered an ischemic stroke present atrial fibrillation [25], corroborating these finds ischemic stroke with cardioembolic Toast was very prevalent in the tertiary hospital evaluated Albert Einstein, as well as in the present study. Lange et al. [23] also reported that between their group of 359 patients 18,3% of the patients presented atrial fibrillation, besides that 58% of the 107 patients that suffered an ischemic stroke due to cardio embolism presented atrial fibrillation and 94% of the patients that presented atrial fibrillation suffered an ischemic stroke due to cardio embolism, demonstrating the importance of this arrhythmia for the stroke development [16]. In the present study 87,5% of the patients that presented atrial fibrillation suffered an ischemic event due to cardio embolism and 36% of the patients that suffered a cardioembolic event presented atrial fibrillation. Perera et al. [26] after studying 14 patients who presented an ischemic stroke with a previous history of subclinical atrial fibrillation 57% of them presented cardioembolic Toast. However among 5 patients who had subclinical atrial fibrillation detected within 30 days before their ischemic stroke episode, 80% presented a cardioembolic stroke [26]. Those findings speaks in favour of our results.

### Diabetes mellitus

Diabetes mellitus is considered an independent risk factor for the development of ischemic stroke and it can raise 4 times the risk to develop the disease [10]. Boehme et al. [4] reported that diabetes is an independent risk factor for stroke with a 2-fold increased risk and stroke represent approximately 20% of deaths in diabetics patients [4]. Among Lange et al. [23] 359 patients group 30,3% of them presented diabetes. 38,2% of their patients who presented

microangiopathy as their Toast presented diabetes [23]. This study showed that 32% of the patients analyzed have diabetes. Among our microangiopathy Toast patients 46,4% presented diabetes. Others significant studies founds that this prevalence can vary from 22% to 45% [8,27].

### Smoking

Guzik et al. [8] showed that the smoker patient has a 2-fold increased risk to present an ischemic stroke and it was also observed that the risk is dose dependent [8,4]. Boehme et al [4] also reported that cigarette smoking doubles the risk for ischemic stroke. They also estimate that smoking is reesponsible for approximately 15% of all stroke deaths per year. Even secondhand smoke is as an independent risk factor for stroke, once this population present a 30% increased risk of stroke [4]. Yao et al. [22] reported that in the 858 ischemic stroke patients group 23,1% of them smoke. Among Lange et al. [23] 359 patients group 26,4% of them were current smokers when they presented their first ischemic stroke. Besides that 36,7% of their great vessels disease Toast patients were smokers [23]. In the present study 31% of the patients presented high rates of smoking. Among the patients who presented great vessels disease as the stroke Toast, 46,4% of them smoked, showing the importance of smoking for the development of this Toast. Other Toast that presented high rates of smokers was the other causes Toast (66,6%), however we only had 3 cases of this Toast so this data doesn't has a significant estatistic value.

### TIA occurrence

TIA occurred in 27% of our patients. 52,3% of this population presented cryptogenic Toast and 26,2% presented as its Toast cardioembolism. 59,4% of the patients who presented cryptogenic Toast presented a TIA. In the U.S.A the rates varies from 1% to 6% and 10% of patients that presented a TIA will develop an ischemic stroke in the next 90 days [12,7]. Giarola et al. [28] reported that 15 to 30% of all strokes are preceded by TIA. Ater analyzing 258 they showed that 31 patients presented a previous TIA (12%) [28]. It's likely that the high rate of TIA occurrence found in the present study is due to the high level of cardioembolic Toast, that is associated to transitory events. However the cryptogenic Toast has a major importance for the TIA etiology, what shows that the TIA occurrence is probably related with many others factors, such as PFO presence as described by Mazzucco et al. [29]. The risk factors rates of TIA patients is very similar compared to all patients who suffered an ischemic event, so the same risk factors for the occurrence of an ischemic stroke is a risk factor for TIA occurrence. However 100% of patients who presented Moyamoya Disease had a TIA and not an ischemic stroke, what shows that patients who present this disease has a major risk to develop a TIA. TIA's topography is similar to the total population of this study also, once the anterior circulation is the most affected.

### Sex

About the prevalence of the ischemic stroke according to the sex, we had conflicting data with the literature [8]. Lange et al. [23] for example reported that among their 359 patients 49% of them

were woman [23]. Haast et al. [30] also stated the importance of female sex as a risk factor for the stroke incidence, especially in postmenopausal women, once the authors presented a relation between the sex hormones, which plays a role in the vessel dynamics (dilatation and atherosclerotic process). In the present study 61% of the patients analyzed were man and 39% were women.

### Toast

About the stroke etiology in this study 18% of the strokes analyzed presented as its Toast great vessels disease, in the literature it's seen a rate that varies from 14% to 40% [2,10,31]. Among the 258 patients analyzed by Giarola et al. [28] 16% of them presented great vessels diseases as its Toast [28]. Between the 359 patients that Lange et al. [23] analyzed 22% of them presented as the stroke Toast great vessels disease [23]. Even in levels usually not so high, the constancy of this etiology in several countries can be seen. In fact, this Toast is related with high rates of carotid atheromatosis found, which in this study is present in 42% of the cases, being the most important comorbidity found. Dyslipidemia occurrence is usually related with this Toast. In Lange et al. [23] study only 23,7% of the patients that suffered an ischemic stroke and presented dyslipidemia had great vessels as the stroke's Toast, but among the patients that suffered a stroke due to great vessels disease 63,2% of them presented dyslipidemia [23]. In the present study 16,5% of the patients analyzed presented dyslipidemia. Among those patients only 15,3% presented great vessels disease as the event Toast and only 14,2% of the patients total who presented this Toast presented dyslipidemia. Therefore this leads us to think that dyslipidemia isn't more important in great vessels disease Toast, this risk factor impacts and increases the chance of all kind of stroke occurrence. We confirmed that once the prevalence of dyslipidemia is very similar in cardioembolic, great vessels, microangiopathy, other causes and cryptogenic Toasts, they were respectively 16,4%; 14,2%; 17,8%; 33,3% and 16,2%.

In the present study 18% of the ischemic events were caused by microangiopathy. Several of the main studies shows a percentage ranging from 15% to 30% for ischemic strokes with microangiopathic Toast [10,31]. Among Giarola et al. [28] patients 11% of them presented microangiopathy as its Toast [28]. Lange et al. [23] showed a prevalence of 19% for microangiopathic Toast among the 359 patients studied [23].

In the present study 39% of the ischemic events analyzed have 39% of cardioembolic Toast. In the literature it's found a rate ranging from 15% to 30% [1,31].

Giarola et al. [28] reported a prevalence of 42% for cardioembolic Toast among their patients [28]. Lange et al. [23] showed a prevalence of 30% of cardioembolic Toast in their patients [23]. Therefore, it was found in this study a higher rate, that we credit to a broad realization of the exam 24 hours cardiac Holter, what increase the sensibility to detect intermittent atrial fibrillation when compared to the electrocardiogram. Nevertheless, the practice of the electrocardiogram realized in two periods during the hospitalization increase the chance of detection of that

atrial arrhythmia. The literature describes rates from up to 40% of ischemic stroke with cryptogenic Toast occurrence [3,31,32], what goes against our findings, because this study has a cryptogenic Toast rate of 23%. We also credit this rate to a broad realization of 24 hours cardiac Holter. Giarola et al. [28] reported a 25% rate of cryptogenic Toast among their 258 patients [28]. Lange et al. [23] showed a prevalence of 23% for cryptogenic Toast [23]. Those findings shows that a wide search for the ischemic event etiology result in a wide capacity to determine its Toast. Agreeing with our findings, some researchs shows the importance of ministrate anticoagulants in patients with cryptogenic stroke, that present some abnormalities, like: LAAT, PAF or a PFO [14,15]. Mazzucco et al. [29] after studying 264 patients who presented cryptogenic events and underwent a bubble-TCD reported a significant association between right to left shunt (PFO) and cryptogenic events in the older population [29].

### Topography

In the present study 83% of the patients suffered an ischemic event with anterior circulation impairment and 17% of them involved the posterior circulation, corroborating the literature findings, like Schulz et al. [19], who described that 20% of the strokes are located at posterior circulation [10,19]. Among the posterior circulation patients 23% of them presented cardioembolic Toast, 23% great vessels disease, 46% microangiopathy, 4% other causes and 4% other causes. Among the patients that presented an ischemic event due to microangiopathy 42,8% of them were at the posterior circulation and among the patients who had great vessels disease 21,4% of them were at the posterior circulation. Therefore we conclude the importance of microangiopathy for the posterior circulation ischemic events. The great vessels disease is the second most important Toast for those events.

### Conclusion

After analyzing the 157 patients, selected to the study, many characteristics showed high prevalence. The patient that suffers from an ischemic event often have some cardiovascular alterations, such as mitral insufficiency or aorta ectasia, a lot of times they present carotid atheromatosis despite the Toast. However each Toast present particular risk factors that has major influence on each of them, as well as specific characteristics. Atrial fibrillation and other heart diseases are some findings that are present in many cases and influence the stroke's etiology, even when the stroke is cryptogenic, cardiovascular diseases must be analyzed, once the use of anticoagulation may be an alternative in some cases. Therefore investigational exams must be widely requested and analyzed for the practice of a better secondary prophylaxis. Hypertension, diabetes, smoking, ethilism and dyslipidemia are the most important risk factors for ischemic stroke and TIA patients. Transitory symptoms that do not cause changes in the exams can't be despised, because there is a significant rate of TIA cases and many times those preced the occurrence of an ischemic stroke or those cases can disclose a vasculopathy, such as Moyamoya Disease. Treatments like the carotid revascularization, anticoagulation, antiplatelet agents, statins, antihypertensive drugs and lifestyle

changes are responsible for a reduction of 80% in the occurrence of an ischemic event, so we highlight that a specialized monitoring in a vascular neurology center decrease drastically the recurrence and the occurrence of an ischemic event as it's observed over this study.

## Acknowledgement

None.

## Conflict of Interest

No conflict of interest.

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