

# Arterial Territories Affected in the Thalamic Stroke: A Prospective Study Among Inpatients in Lome University Hospital, Togo

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**Abstract:** Background and purpose: The thalamic infarct is frequent among ischemic stroke. We aim to determine the frequency of the thalamic infarct and analyze the different arterial territories affected in patients with thalamic syndrome. Patients and Methods: It was a prospective study. It focused on patients hospitalized in the neurology department of our university hospital, and covered the period from January to December, 2012. Only inpatients respondents to clinical and radiological criteria for diagnosis of thalamic ischemic stroke were included. All were evaluated with detailed clinical and neuropsychological evaluation, computer tomography scan (CT scan), routine blood studies, electrocardiogram, and transthoracic echocardiography. All standard risk factors were recorded in these patients. Results: A total of 768 files were analyzed of which 219 cases of cerebral infarction were selected. Among them, 12 patients had lesions involved only thalamic nuclei, which giving the frequency of 5.48%. The mean age was 59.33 years old with a ratio sex of 1.7. The clinical signs most observed were motor deficits (8/12), speech disturbances and anterograde memory impairment (7/12), and sensory loss (5 cases). The high blood pressure was the main risk factor in all patients. The left thalamic ischemia was most frequent with 7/12 cases. The arterial territories affected were formed by the thalamotuberal arteries in 5/12, thalamoperforating arteries, (4/12), thalamogeniculate arteries, (3/12) and posterior choroidal arteries in 2/12, giving fourteen lesions. Conclusion: Thalamic infarct solely is not so rare and all its arterial branches may be affected. The sensory deficits and abnormal involuntary movement remain the embarrassing and difficult symptom to manage.

**Keywords:** Arterial Territories, Involuntary movement, Strokes, Thalamic Infarct

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## 1. Introduction

The thalamic stroke becomes more common than previously believed and account for 11% of all vertebrobasilar infarcts.<sup>[1]</sup> The thalamus is a diencephalic structure whose nuclei represent a gateway for input and output to and from the cerebral cortex. The thalamus is supplied by four arterial branches, (thalamoperforating, thalamogeniculate, thalamotuberal and posterior choroidal arteries).<sup>[2]</sup> These arterial branches vascularize four corresponding arterial territories. Vascular lesions in each of

these territories give rise to distinct clinical syndromes.<sup>[3-5]</sup>

Clinical manifestations are mainly characterized by sensorimotor deficits, neuropsychological disorders, memory impairment, speech disturbance and involuntary movement that handicap the patient's daily life.<sup>[3,5]</sup> The study therefore aimed to determine the frequency of thalamic infarction and analyze the different arterial territories obstructed with the major risk factors involved in the neurology department.

## 2. Patients and Methods

### 2.1. Setting

The study was a prospective and longitudinal, located in neurology department in the level 3 hospital of the largest city of the country. Consecutive patients aged of 15 years old and over with acute thalamic stroke (but not subarachnoid hemorrhage and hemorrhagic stroke) that provided informed consent were registered from January to December, 2012. The study was approved by the Ethics Committees of the University Hospital. The neurology department has a capacity of 40 beds with an emergency neurovascular room. It also has a neuromuscular biopsy unit, and EEG and EMG labs. This service receives an average of 1600 outpatients and 750 hospitalized patients per year.

### 2.2. Assessments

Each registered patient was assessed directly or by proxy responders (when the patients could not answer the questions themselves) as soon as possible after stroke onset, predominantly by in-person interviews, and at 6 months by either telephone or in -person interviews on periodic visits. We have used six months for patient screening and six other for follow up.

We selected among these patients with stroke, those who met the definitive diagnosis of thalamic infarct on clinical signs and computer tomography (CT) scan examination. We have not included patients with loss of consciousness with no localizing signs, seizures with post critical deficit, transient ischemic attack, hemorrhage of the thalamus and the brain parenchyma, and patients with suspected stroke without cerebral imaging. Each patient was seen on average of three times before the end of the study. The neurological and physical examinations were conducted by the principal investigator, and trained neurologist. The following data were recorded: demographic features, risk factors, cardiac examinations, clinical course and type of stroke, mechanism, and vascular territory. Hypercholesterolemia was defined as cholesterol serum levels  $>5.2$  mmol/l (220 mg/dl) and hypertension as blood pressure  $>160/90$  mm Hg recorded at least twice before stroke. Cigarette smoking, diabetes mellitus, hypercholesterolemia, and hypertension were considered as atherosclerosis-predisposing factors for data analysis. Occupation was either “manual” (which included construction, farming, transportation and driver, and unemployed) or “non manual” (which included management, professional and related, sales/commercial and armed forces). We examined the records of all patients with a diagnosis of thalamic stroke confirmed by CT scan, read by a senior neuroradiologist. The vascular territory involved was assessed using the templates proposed by Damoise.

### 2.3. Statistical Analysis

Because of the small number of cases involved, the data on clinical course according to the vascular territory affected were analyzed using manual descriptive statistics.

## 3. Results

### 3.1. Clinical Outcome

A total of 768 patients included in the study, 446 were suspected of stroke, 219 were assessed at 6 month to bear ischemic stroke in which 12/219 (5.48%) had a thalamic infarction. These 12 patients have constituted the sample of our study with 7 men and 5 women representing a sex ratio of 1.4. The mean age of onset was 59.33 years ranging from 35 to 85 years-old. It was 63.5 years for women with extremes of 50 and 83 years and 57.25 years for men with extremes of 35 and 67 years. Patients of 56 to 75 years old were the most represented with 10 cases.

With regard to admission, nine were directly admitted to the neurology department and three were initially treated in private clinics or peripheral hospitals before being transferred to the stroke care unit. The average period of taking care between the onset of symptoms and admission to hospices was 7 days with extremes of 1 and 62 days. All patients were known hypertensive but others had more diabetes (3/12), and two had a history of ischemic stroke relapse, and another HIV1 positive. The partial motor deficit, (10/12), language and neuropsychological disorders with and without loss memory, (8/12), and paresthesia (6/12) were the most frequent reasons of admission.

All patients have done a brain scan without contrast, showing a unilateral or bilateral thalamic low density. None of them had received a second imaging. The time between admission and completion of the scan was on average of 31.33 hours with extremes of 3 and 168 hours, including 8/12 within 48 hours.

### 3.2. Brain Imaging of Arterial Territories Involved

On CT scan findings, 6 patients had a left thalamic lacuna, 4 right thalamic ischemia and 2 cases of bilateral thalamic infarcts involved. The left thalamic ischemia was most frequent with 8/12 cases. The arterial territories affected were formed by the thalamotuberal arteries in 5/12, thalamoperforating arteries, (4/12), thalamogeniculate arteries, (3/12) and posterior choroidal arteries in 2/12, giving fourteen infarcts lesions. Figure 1 show the arterial territories affected in thalamic infarction from 1<sup>st</sup> to 12<sup>th</sup> patients.

### 3.3. Stroke Risk Factors

Concerning the search of the risk factors, the electrocardiogram was performed in 10/12, 3 cases of left ventricular hypertrophy and 7 cases of under epicardic ischemic lesions were observed. On the heart and vascular ultrasound with Doppler recording, there was a diffuse carotid atherosclerosis in all cases, an ulcerated plaque in 9 cases, and poor relaxation of the left ventricle in one patient. Signs of hypertensive retinopathy in eye fundus were observed in 12 cases. The biological diagnostic tests objectified hyperglycemia (3cases), high LDL cholesterol and triglycerides (8cases), and high homocysteinemia level in 7 cases (Normal  $\leq 15$ micromol/l).

### 3.4. Medical Management

With regard to medical management, 9/12 and 3/12 were treated respectively with aspirin and clopidogrel. We have established a management of the risk factors for secondary stroke prevention. The outcome was favorable with 12 cases of complete recovery of the motor and sensory deficits and functional rehabilitation. In the follow-up to 6 months, we observed the appearance of residual thalamic pain (2 cases), and one case of thalamic hand syndrome.

## 4. Discussion

### 4.1. Methodology, Strengthen and Weakness

The main objective of our study was to identify thalamic infarcts and clarify the different arterial territories affected. This reduces dramatically the size of our sample because many records patient files had been rejected. They did not follow the selected criteria. This has been a bias in the recruitment of patients with thalamic stroke. Another limitation of the study were that we were unable to assess all patient admitted for stroke in the city. The study was also limited on time and space (short period of data collection and one center of patient registration). This may not reflected the real frequency of thalamic infarction in the whole country. Finally, because we only included survival inpatients, we were unable to collect patients who could not afford hospital care or were more likely to attend basic clinic-type (Level 1) hospitals.<sup>[6-8]</sup> However, the consistency of our results with previous studies provides some validity to the data.

### 4.2. Analysis of Epidemiological Data

The thalamic infarct had represented 5.48% of all ischemic strokes established. This relatively high frequency is due to the proximity of the thalamus with the internal capsule whose involvement is particularly common and frequent in stroke.

The sex ratio was 1.4. The male predominance is common to several studies in the literature. This could be linked to the presence of several risk factors often associated in the same patient, but it remains many unknown risk factors to explain this phenomenon of male predominance in our study.

The average age of our patients was 59.33, ranged from 35-85 years. This average age is not so different from that generally reported in the literature for ischemic strokes which ranging from 59.8 to 64.2 years old.<sup>[7-10]</sup> Studies had demonstrated that infarction of the thalamus as other ischemic strokes occur in elderly people more than cases reported in young people.<sup>[11]</sup> The delay in caring of patient is a daily difficulties encountered in south Sahara African countries. Therefore, the patient must self-insure all hospital costs associated with its treatment. In addition, the first contacts are traditional healers and care facilities close before

making a reference to hospital in case of complications or unsuccessful treatment. In the rare case of health insurance or social security system, the procedures for providing background are not as simple.

The inquest concerning the management of stroke in Europe in 2000, found an average delay of 15 hours between first symptoms and the arrival to emergency unit, and only 50% of patients arrived in the first three hours recommended on the task force.<sup>[4,10,12-14]</sup> Hypertension is the universal risk factor in the occurrence of stroke followed by diabetes, heart disease, and small-vessels diseases.<sup>[7,8,15,16]</sup>

### 4.3. Thalamic Arterial Territories Obstructed

Computed tomography provides essential arguments in the diagnosis of stroke to distinguish the ischemia from hemorrhage. The delay for making CT scan depends on patient financial conditions. This lead-time is long with an average of 31.33 hours and extremes of 3 and 168 hours.

Regarding the arterial territories involved, we have recorded 41.66% cases of ischemia in the territory of thalamoperforating artery, 33.66% in the territory of the thalamotuberal artery, 25% in the thalamogeniculate and 16.33% in the posterior choroidal arterial territories. Similar results were previously reported in literature.<sup>[13,17-19]</sup>

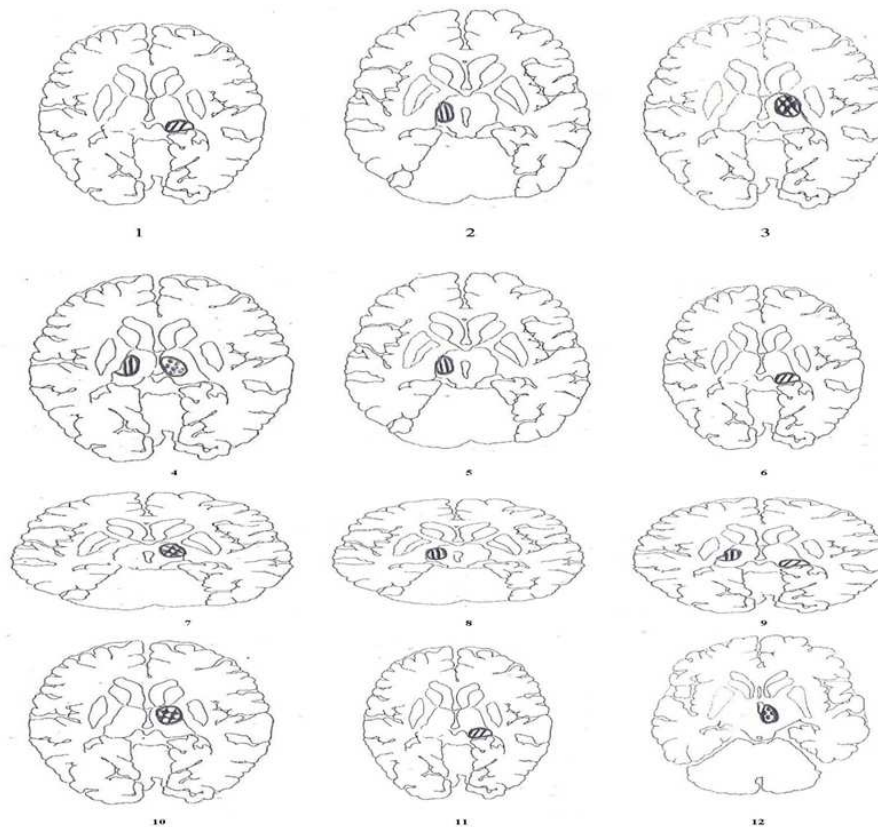
There are significant variations concerning thalamic vascular supply. It is classically categorized into 4 territories: anterior, paramedian, inferolateral, and posterior.<sup>[20]</sup> The thalamus and the midbrain receive their blood supply from both the anterior (internal carotid arteries) and posterior (vertebro-basilar system) circulations, and several variations in this supply are known to exist.<sup>[2,21]</sup> The findings also suggest that each type of pathology (atrophy, small vessel diseases, and strategic infarcts) contribute independently to the pattern of cognitive disabilities associated with dementia. Particular attention to cerebrovascular diseases in deep white or gray matter structures of the thalamo-cortical system is certainly warranted.<sup>[22,23]</sup>

There were no potentially eligible patients for thrombolytic treatment because arrival time is over 3 hours of onset and the presence of lacunes.<sup>[24,25]</sup>

We had not recorded any deaths during the study. A good prognosis and outgoing without sequels has been reported in several studies if thalamic lesions were early detected with quiet treatment.<sup>[12,26]</sup>

## 5. Conclusion

This study highlights the importance of thalamus arterial territories affected among the whole ischemic stroke. The consequences of thalamic nuclei involved show the need to develop systems to assist patients and the management of the risk factors to reduce ongoing disabilities due to strokes.



**Figure 1.** legend: Arterial territories occluded from 1<sup>st</sup> to 12<sup>th</sup> patients: Thalamoperforating branches 4 (33,33%), thalamotuberal branches 5 (41,66%) ; Thalamogeniculate branches 3 (25%), Posterior choroidal branches 2(16,33%).

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