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Review Article

Cardioembolic Cerebral Accident: Epidemiological and Paraclinical Aspects at the Brazzaville University Hospital

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Abstract: Purpose: to show the value of the Doppler echocardiogram and the Holter-ECG performed systematically during the etiological assessment of a first episode of ischemic stroke. Methods and patients: this was a prospective and descriptive study, carried out from May 1 to October 31, 2020 (six months) in the cardiology and neurology departments of the Brazzaville University Hospital Center. It included patients who had a first episode of ischemic stroke confirmed on brain scan and carried out a cardiological assessment. Results: fifty patients were included, including 26 women. The mean age was 63.9 ± 12.8 years (34 - 82 years). Transthoracic echocardiography and ECG detected emboligenic heart disease in 42 cases (84%), major heart disease in 38 cases (76%). The major emboligenic heart disease was dilated cardiomyopathy in 17 cases (34%); ischemic heart disease in 6 cases (12%), mitral stenosis in 2 cases (4%), and atrial fibrillation in 13 cases (26%). The Holter-ECG revealed permanent atrial fibrillation in 13 patients (26%), paroxysmal atrial fibrillation in 1 patient, paroxysmal atrioventricular block in one patient. Conclusion: in our work, the echocardiogram and the Holter -ECG made it possible to identify twenty-nine thromboembolic causes of stroke. These explorations are essential in the etiological assessment.

Keywords: Ischemic Stroke, Emboligenic Heart Disease, Holter-ECG, Echocardiogram

1. Introduction

In the West, the place of cardioembolic strokes as a cause of DALYs is well and truly recognized [1, 2]. In Africa, Moroccan, Senegalese, Algerian, Malian, and Togolese authors [8-13] also reported the epidemiological-clinical aspects of this pathology, while emphasizing the contribution of echocardiography and Holter-ECG. In Congo, Kimbally - Kaky et al [14] reported their experience from a series of 21 cases of cardioembolic stroke recorded at the Brazzaville University Hospital and studied using echocardiography; and [31, 35] Ondzé - Kafata et al highlighted the value of Holter-ECG and echocardiography in the assessment of an ischemic stroke. The objectives of this work were: To determine the frequency of ischemic thromboembolic stroke among cases of ischemic stroke, to describe the general characteristics of patients who have had a cardioembolic ischemic stroke, to identify the main emboligenic heart diseases by highlighting the contribution of Doppler echocardiography, listing on Holter-ECG, rhythm disturbances at high risk of thromboembolism. Material and method This is a single-center prospective descriptive study carried out from April 1 to October 30, 2020 in the cardiology

and internal medicine department of Brazzaville University Hospital.

2. Methods

Inclusion Criteria

Were included: - patients hospitalized in the neurology and cardiology departments of the University Hospital of Brazzaville for a clinical diagnosis of a first episode of ischemic stroke confirmed by brain scanner [2, 3] patients having carried out a minimal cardiological assessment which included an electrocardiogram (ECG), a Holter-ECG, a cardiac ultrasound, the patients having given their written consent to participate in the study 1.7. Parameters studied They were: - epidemiological: age, sex, profession, marital status, level of education; - clinical: cardiovascular FDR, medical ATCD, habitus, reason for consultation, abdominal circumference, consciousness, BP level on admission, HR, neurological signs, other physical signs; - paraclinical: 1) biology: hemoglobin level, serum creatinine, fasting blood sugar, total cholesterol, triglycerides, HDL-C, and LDL-C; 2) ECG to look for AF, extrasystoles, LVH (left ventricular hypertrophy), conduction disorder, signs of myocardial ischemia, sequelae of MI (myocardial infarction); 3) Holter-ECG; 4) Doppler echocardiography looking for an intracavitary thrombus which is a frequent complication in the acute phase of an MI, in cases of ventricular aneurysm or dilated cardiomyopathy (up to 60% of cases at autopsy). In the acute phase of an MI, the thrombus forms during the first few days. The embolic risk remains high during the first month. It is all the higher if the thrombus is mobile, bulky and the adjacent wall is hyperkinetic. The risk of systemic embolism in the event of an aneurysm is 5 to 7%. Echocardiography will also assess underlying heart disease and foramen ovale; 5) brain scanner for the diagnosis and topography of stroke, 6) LIRM has greater sensitivity than computed tomography (CT) to demonstrate cerebral ischemia in the acute phase, in particular using a sequence broadcast [6, 7]. In addition, it can highlight elements in favor of a cardioembolic etiology, such as the presence of multiple ischemic lesions in several vascular territories and/or both cortical and subcortical damage. These ischemic lesions are strongly associated with a cardioembolic mechanism. These aspects may not have been noted on brain CT. The parameters studied were recorded on a computerized survey form using epi Data software version 3. Data analysis was carried out with SPSS software version 17 (Chicago USA) The frequency and percentage were estimated for the qualitative and dichotomous variables. The mean, median and standard deviation were calculated for quantitative variables.

3. Result

3.1. Epidemiological Aspects

We carried out a prospective and descriptive study from May 1 to October 31, 2020, a period of six months. The sample was 50 patients meeting the inclusion criteria including 26 women and 24 men for an ischemic stroke with a complete medical file, i.e. a hospital frequency of 14% of all ischemic strokes recorded during this period. period. the average age of our patients was 63 +12.8 years, with extremes of 34 and 82 years. the most representative age group was over 60 years old, i.e. patients. A female predominance was noted in our series, i.e. 52% (26 patients), with a sex ratio of 1.08. cardiovascular risk factors (Table 1) were dominated by known hypertension in 39 patients (78%), followed dyslipidemia in 13 cases (26%). Familial hypertension was noted in 9 patients (18%), it was associated with diabetes in 7 cases (14%), abdominal obesity was in 7 patients (14%), active smoking in (4%) patients. Cardiovascular history such as CMD was found in 5 patients (10%) and mitral stenosis in one patient (2%). There were 24 patients (48%) married, and thirteen patients (26%) single. Among these patients, 15 patients (30%) had no education; 15 had primary school levels (30%) and 15 others had secondary school levels (30%). Five (10%) patients had higher education and 24 patients (48%) were unemployed.

Table 1. *History and FDR noted in the 50 patients.*

	N	%
Sedentary lifestyle	46	92
Known hypertension	39	78
Dyslipidemia	13	26
Family hypertension	9	18
Known diabetes	7	14
Abdominal obesity	7	14
CMD	5	10
Active smoking	4	8
Active alcoholism	3	6
RM	1	2

CMD = dilated cardiomyopathy; hypertension = high blood pressure; RM = mitral stenosis

3.2. Clinical and Paraclinical Aspects

The reason for cardiological consultation was dominated by dyspnea in 6% of patients and palpitations in 36% of patients, while the reason for neurological consultation was dominated by motor deficit in 52% of patients, followed by motor deficit plus language disorder. in 16% of patients, motor deficit plus facial paralysis in 10% of patients, disorders of consciousness in 6% of patients (table 2).

Table 2. *Reasons for patient consultation.*

	N	%
Isolated motor Déficit		52
deficit Motor deficit + language disorder	16	32
Motor deficit + facial paralysis	4	8
disturbances of consciousness	4	8

Global heart failure was noted in 4 cases (8%) and left heart failure in 2 patients (4%). cardiomegaly was found in 27 patients (54%) with an average cardiothoracic index of 0.6 (0.50-0.75).

Table 3. *Clinical Signs.*

	N	%
Right hemiplegia	29	58
Left hemiplegia	17	42
Disturbances of consciousness	4	8
isolated BROCA's aphasia	12	24
Central facial paralysis	4	8
Dysarthria	4	8
Congestive heart failure	4	8
Left heart failure	2	4

Table 4. *Biological characteristics of patients.*

	Mean ± Standard deviation	Extremes
Hemoglobin	12,27 ± 1,66	8,80 – 15,80
White blood cells	6,22 ± 1,87	3,90 -11,90
Plaquettes	229,22 ± 73,96	123 – 427
sedimentation rate	11,79 ± 12,70	2 – 90
Sugar serum	1,03 ± 0,36	0,65 – 2,86
Creatinine	11,15 ± 5,13	6 – 36

Dyslipidemia was observed as follows: hypercholesterolemia (n= 14; 28%), hyperLDLemia (n= 3; 6%), hypertriglyceridemia (n= 3; 6%). Morphologically, the ECG taken on admission revealed sinus rhythm in 37 patients (74%), atrial fibrillation in 13 patients (26%), negative and symmetrical T waves in 5 patients (10%), sequelae of Apical antero-septal MI in 1 patient (2%). Left ventricular hypertrophy was noted in 8 patients (16%). 24-hour Holter ECG revealed paroxysmal atrial fibrillation in 1 patients (2%). Ventricular extrasystoles in 18 patients (36%), supraventricular extrasystoles in 17 patients (34%), permanent atrial fibrillation in 13 patients (26%) and one case of complete atrioventricular block was observed. The ultrasound aspects were represented by an average ejection fraction of of 58.03 ± 16.54% (range: 22 to 90%), it was moderately altered in 17 patients (34%), severe in 8 patients (16%). The average left atrium (LA) surface area was 19.60+11.29cm2 (range: 19-56.5); the left atrium was dilated in 16 patients (32%); left ventricular hypertrophy was found in 3 patients or 6%.

Table 5. *Electrocardiographic aspects.*

	N	%
Sinus rhythm Atrial	37	74
Atrial fibrillation	13	26
LV hypertrophy	8	16
Extrasystoles	8	16
Repolarization disorders	5	10
Left anterior hemiblock	1	2
Sequelae of anteroseptal MI	1	2

LV = Left ventricular

Table 6. *Electrical aspects noted on the Holter-ECG.*

	Not	%
Sinus Rythm	37	74
Permanent atrial fibrillatin	13	26
supraventricular extrasystoles	17	34
ventricular extrasystoles	18	36
atrioventricular block	1	2
Paroxysmal atrial fibrillation	1	2

Table 7. *Cardiographic and Doppler echo data.*

	Mean and standard deviation	Extremes
LVEF (%)	58,03 ± 16,54	22 – 90
EDDLV (mm)	49,11 ± 12,41	25 - 76
SLA (cm2)	19,60 ± 11,29	19 - 56,5
EDDRV (mm)	19,80 ± 5,49	15 - 43,4
PWLVd (mm)	9,12 ± 2,05	6 - 17
IVSd (mm)	9,14 ± 2,16	5,1-17

EDDLV = end-diastolic diameter of the left ventricle; EDDLR = end-diastolic diameter of the right ventricle; LVEF = left ventricular ejection fraction; OG=left atrium; PW LVd = posterior wall of the left ventricle in diastole; IVSd =interventricular septum in diastole; SLA=surface of left auricle

The LVEF was lowered in 17 cases (34%), the LA was dilated in 16 cases (32%). In 17 patients (34%), LV dilatation was noted. Also in three cases (6%) hypertrophy of the posterior wall of the LV and the interventricular septum was observed. Global hypokinesia was noted in 17 patients (34%), and disturbances in segmental cardiac kinetics in six patients (12%).

Table 8. *Emboligenic heart diseases observed.*

	Not	%
dilated cardiomyopathy	17	34
ischemic heart disease	6	12
hypertensive cardiomyopathy in the hypertrophic stage	3	6
Mitral stnosis	2	4
Calcification of the mitral annulus	1	2

Emboligenic heart disease (EC) was classified into major and minor. Emboligenic heart disease was noted in 42 patients (84%). The EC was major in 38 cases (76%) and minor in 4 cases (8%). It was subdivided as follows: -1) major CE: dilated cardiomyopathy = 17 cases (34%); atrial fibrillation = 13 cases (26%) (on underlying heart disease 10 times, idiopathic 3 times) ischemic heart disease = 6 cases (12%); mitral stenosis = 2 cases (4%); 2) minor CE: hypertrophic cardiomyopathy of hypertensive origin = 3 cases (6%); calcification of the mitral annulus = 1 case (2%). Arterial Doppler ultrasound did not find any major atherosclerotic plaque in all our patients. On the brain scan, all the patients' results were in favor of a cerebral infarction and two cases of hemorrhagic rearrangement were subsequently observed.

Table 9. *Topography of the stroke on CT.*

	Not	%
Sylvian artery	33	64
Middle cerebral artery	1 3	2 6
Basilar trunk	3	6
Posterior cerebral artery	1	2

4. Discussion

4.1. Criticism of the Method

Our work focused on the cardiac assessment (in particular the Doppler echocardiogram and the Holter -ECG) carried out systematically during a first ischemic stroke in patients hospitalized in the neurology and cardiology departments of

the Brazzaville University Hospital. The population studied is not representative due to the inclusion criteria, including the systematic performance of a Holter-ECG and an ETT. TEE is not available in the Cardiology department of Brazzaville University Hospital. Which is a second bias of our work. Indeed this examination makes it possible to perfectly visualize certain structures which are not detected by the ETT (the left auricle, almost the entire thoracic aorta, the vegetations whose diameter is < 2 mm) thus increasing the diagnostic profitability in patients who have had an ischemic stroke [15-17].

4.2. Prevalence

The prevalence of cardioembolic ischemic stroke in our series was 8.04% of DALYs hospitalized in the neurology and cardiology department of Brazzaville University Hospital. According to literature data, this prevalence varies depending on the Authors: in Mauritania (13.95%) [4], in Senegal (15.33%) [19], in the United States of America (25.7%) [20]. this low prevalence in our series could be explained not only by the small size of our sample, but also by the fact that life expectancy is high in wealthy countries.

The average age of our patients was 63.9 ± 13 years. Which puts us in agreement with the Moroccan [10], Senegalese [18] and Mauritanian [4] authors whose patients were aged respectively 60.8 ± 12.14 years, 63.48 ± 15.85 years and 64 years. The data reported by the French authors [1, 11, 21] are comparable to ours, the average age of onset of stroke being 66.3 years. It is therefore appropriate to emphasize that the incidence of stroke increases with age. However, thromboembolic strokes can be seen in both the elderly and young people [14]. The youngest patient in the series by Kimbally-Kaky et al [14] was 15 years old. The minimum age was 29 years in Lomé [13], and 34 years in our work.

4.3. Sex

Concerning sex, the data differs depending on the study. Generally speaking, a male predominance has been observed by several authors [10, 22]. Our data argues in favor of a female predominance (52%). Kimbally-Kaky et al [14] previously in the same department, Broom A et al [34] and Sirake Camara et al [4] made the same observation. A plausible explanation: the easier consultation of women when faced with a symptom. Our series included 78% of hypertensive patients, data comparable to those of Bendris et al [10], at 71%. In Lomé [13] and Dakar [35], the proportion of hypertensives was 60 and 65.4% respectively. Thus, hypertension was the main factor in the occurrence of ischemic strokes. In our work the other FDRs were diabetes, abdominal obesity, dyslipidemia (26%, 14%, and 14% of cases respectively). Without forgetting smoking (8%). these modifiable cardiovascular risk factors are classically described, so they must be screened, identified and managed in order to minimize the occurrence of DALYs. Chronic alcoholism gradually increases the risk of stroke [6]. This situation was noted in 6% of our patients and 31.8% in the series by Damorou et al in Lomé [13]. Generally speaking, this situation requires an emphasis on primary prevention. This involves: early detection of hypertension and its treatment; the fight against the other FDRs; a healthy lifestyle. In our series, the clinical symptoms were dominated by isolated motor deficit in 26 patients or 52%, motor deficit and language disorders in 16 patients or 32%. Motor deficit and facial paralysis in 4 (8%) patients and isolated disorders of consciousness in 4 patients (8%). Similar findings have been reported in the literature [23-29] Our patients (52%) more frequently consulted for an isolated motor deficit. Damorou et al [13] made a similar observation in Togo, reporting a hemi-body motor deficit in 79.12% of cases. Concerning previous heart disease, it was known in 5 (10%) of our patients and consisted respectively of Dilatated Cardiomyopathy (five cases), one case of MR. Previously in the same department [14] the underlying heart disease was rheumatic valvular disease (15 cases including a mechanical prosthesis and two bioprostheses), hypertensive (4 cases), Dilated cardiomiopathy (2 cases). In Morocco [10], six cases of MR and 4 cases of CMD were recorded. In our context, the prevention of thromboembolic strokes involves curative and preventive treatment of streptococcal infections, early detection and treatment of hypertension, education of cardiac patients for good therapeutic compliance and compliance with check-up consultations.

4.4. Clinical and Paraclinical Signs

Neurologically, motor deficit was the main clinical expression in our study (92%). The same observation was made in Lomé [13] with 79% and in Brazzaville [14] previously with 76.2%, in Mauritania 74.25% [4], and 84.2% in the series by Hamady et al [23]. Moreover, Balogou [25], Damorou [28] and Kouna [24] revealed a motor neurological deficit in their study in 51.1%, 79.12% and 96.1% respectively. On the other hand, CI was observed in only 12% of our patients, compared with 28.6% previously in the same department [14]. This may be due to the greater number of advanced valvulopathies observed by these authors.

The ECG performed on all our patients revealed AF in 26%. Our results are comparable to those of Bendris et al in Morocco [10] and Damorou et al in Togo [13], at 17.3% and 19.78% respectively. Arterial hypertension is the next most common cause of this rhythm disorder.

According to the literature [5, 13, 14, 20], electrocardiographic abnormalities are noted in 60-90% of cases, and AF can be detected in 25% of patients.

Holter ECG, a non-invasive test, can be used to detect paroxysmal rhythm disturbances not detected on ECG. It is recommended in the acute phase of a stroke.

This makes it possible to look for a potentially embolic arrhythmia such as atrial fibrillation or atrial flutter. In our study, Holter ECG revealed permanent AF in 26% of cases and paroxysmal AF in 6%. AF is a major cardioembolic complication. Screening for AF is essential, and initiation of anticoagulant or even antiarrhythmic therapy can reduce the risk of recurrent stroke. However, the frequency of AF varies

according to the method of patient selection and the duration of recording. The frequency of this rhythm disorder was 17.3% and 19.7% in Raba [10] and Bamako [12], respectively.

Lazzaro et al [27] reported a lower frequency of around 6%. Ondzé et al [28] performed a systematic Holter-ECG on 81 patients hospitalized for a stroke, and noted a potentially emboligenic arrhythmia in 9.6% of cases. From a review of the literature Amdem et al [36] showed an additional rate of paroxysmal AF detected by Holter compared to ECG of around 6.2%. It is currently accepted that increasing the duration and repetition of recordings increases the chances of recording a paroxysmal rhythm disorder [30]. Despite the lack of consensus on the duration, the ideal time to detect a rhythm disorder, the Holter - ECG remains a simple, non-invasive and very cost-effective means in cases of rhythm disorder or paroxysmal conduction in the acute phase of a stroke or in the medium term [32]. We observed 1 case of paroxysmal AF and 1 case of complete paroxysmal BAV. This allows patient care to be adapted. However, the ability of Holter -ECG to detect such arrhythmia in patients who have had a stroke is low (1-5% of cases), according to Lazzaro [30]. 3.2.2. Other abnormalities observed on the Holter-ECG We noted ESSV in 15 patients. They were not predictive of the occurrence of AF. Previous work [29] reported that: 1) in patients presenting more than 70 ESSVs per 24 hours the risk of noting AF was 25% on the Holter-ECG extending to 7 days; 2) more than 30 ESSVs per hour were associated with a greater risk of occurrence of AF, stroke recurrence, and death. Therefore, the presence of atrial extrasystoles should lead to the performance of a long-term Holter-ECG beyond 24 hours. We also observed ESV in 17 patients (34%) in our series. They did not present any malignancy. VSEs occur with greater frequency when advanced heart disease coexists [5].

In our study, echocardiography revealed major emboligenic heart disease in 38 cases (76%) with Dilated cardiomiopathy being the primary cause (in 34% of cases). Other African authors found lower rates: 13.1% [13] and 13.8% [26], 18.8% [4]. In a review of the literature, Benzarouel et al [5] affirmed the role of impaired LV systolic function in the pathophysiology of ischemic thromboembolic stroke. Given the frequency of in our series, and its role in the pathophysiology of ischemic stroke [5], it seems appropriate to place greater emphasis on its screening in all patients suffering from ischemic stroke. This goes hand in hand with educating patients who have Dilated cardiomiopathy on the need for good therapeutic compliance and good cardiovascular rehabilitation. In our series, MR was noted in 4% of cases. In Dakar [31] and Lomé [13] cases of valvular heart disease were observed with rates of 10.9% and 9.5% respectively. Calcification of the mitral annulus was noted in one case in our series. MR is a very emboligenic heart disease. This difference can be explained by the improvement in the socio-economic level in our region. Ischemic heart disease was observed in 12% of cases, significantly higher rates were reported by Togolese [13] and Congolese authors previously [32]: 13.1% and 27.4% respectively. After myocardial infarction, the risk of DALY is approximately 1.5%/year. The mechanisms are varied (atherosclerosis, AF, left ventricular dysfunction, thrombus persisting after the first month of MI or thrombus formed in an aneurysm of the wall ventricular). On the other hand, heart failure was only observed in 12% of our patients versus 28.6% previously in the same department [14]. This may be the case for the greatest number of advanced valvular diseases observed by these authors and also by the fact that the management of heart failure has evolved significantly in recent years. The frequency of hypertrophic cardiomyopathy of hypertensive origin was 6%, significantly lower than that of 14.5% reported by Ondzé et al [31]. Hypertension being the main cardiovascular risk of stroke can cause concentric and late eccentric LVH. The management of hypertensives makes it possible to avoid this development and therefore to minimize the occurrence of strokes. Intra OG, intra VG thrombus, spontaneous contrast, valvular vegetations and other causes described in the literature were not detected in our work. However, the analysis of the left atrium, the interatrial septum, the region of the fossa ovalis and the thoracic aorta falls under TEE. Indeed, in these situations the superiority of TEE over TTE is established. We do not have a TEE probe in our department. The use of TTE remains limited in the evaluation of cardioembolic stroke. A recent study [33] demonstrated that a major potential source of embolism was detected by TEE in approximately 20% of patients compared to 4% with TTE, regardless of age. Nevertheless, the TTE retains its place and according to the recommendations, this examination constitutes the first stage of cardiovascular exploration in any patient who has had a stroke. Ischemic regardless of age and the existence of underlying heart disease. In our study, the neurological lesion was located at the level of the sylvian artery in 64% of patients. This location is the most frequently observed [1, 21], assertion verified in patients with ischemic stroke in Senegal, where the topography of the stroke was Sylvienne in 89.5% Kane [34].

5. Conclusion

Performing Holter-ECG and echocardiography is an important step in the etiological search for a DALY. In our work, the Holter-ECG essentially revealed atrial fibrillation as a major emboligenic rhythm disorder. However, the dominant echocardiographic appearance was dilated cardiomyopathy. The attributability of ischemic stroke to the heart disease found requires the use of efficient morphological tools (Holter ECG, Doppler echocardiography) to confirm the cardioembolic origin of the stroke. A larger-scale study would allow more information to be collected.

Abbreviations

LVH: Left Ventricular Hypertrophy
TEE: Trans Esophageal Echographia
TTE: Trans Thoracic Echographia
MI: Myocardial Infarction
MR: Mitral Regurgitation
AF: Atrial Fibrillation

ECG: Electrocardiogram

Conflicts of Interest

The authors declare no conflicts of interest.

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