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Carotid Web as a Cause of Ischemic Stroke in Sub-Saharan Africa: A Preliminary Monocentric Descriptive Study of 6 Cases Collected at the Fann Teaching Hospital (Senegal)

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Abstract

Introduction: Carotid web (CW), a rare and probably unknown arterial cause of ischemic stroke (IS), is commonly reported in young black patients, although most of the published cases resided in a non-African country. We describe the features of the first six Senegalese cases diagnosed at the Neurology Department of the Fann Teaching Hospital in Dakar. **Patients and Method:** It was a preliminary retrospective and prospective study conducted at the Neurology department of Fann teaching hospital (Dakar-Senegal). The symptomatic CW diagnosis was based on angioCT-scan of the neck arteries. The National Institute of Health Stroke Scale (NIHSS) and the modified-Rankin Scale (mRS) were used to assess the severity of the IS and the functional disability after the event, respectively. **Results:** CW was causing a left sylvian infarction in 4 patients. The mean age of the patients at the IS diagnosis was 41 ± 6 years with a sex ratio of 1. The mean time to diagnosis of CW was 13 months. Smoking (1/6), hypertension (1/6), and obesity (1/6) were the main vascular risk factors. The mean LDL cholesterol level was 1.52 g/L ± 0.49. The mean initial NIHSS was 15 ± 6 (8-22). Half of the patients had a severe infarction (NIHSS ≥ 15). For secondary prevention, half of the patients were treated with aspirin and the other half with acenocoumarol. After 18 months ± 17 of follow-up, the mean mRS score was 2 ± 1 (1-3). **Conclusion:** CW is an unknown cause of IS in young black patients. An early and appropriate multidisciplinary management could help to reduce the risk of recurrences.

Keywords

Carotid Web, Sub-Saharan Africa, Senegal, AngioCT-Scan, Acenocoumarol

1. Introduction

Stroke, a major public health burden, occurs in 25% of cases in people aged less than 65 years [1] [2]. In our low-income countries, where stroke units and specific revascularization treatments (thrombolysis, mechanical thrombectomy) are not very developed, secondary prevention is a major issue in the management of ischemic stroke (IS), which represents 85% of strokes.

Carotid web (CW), an atypical form of fibromuscular dysplasia (FMD), is a rare and probably unknown arterial cause of IS in young patients [3] [4]. It is frequently observed in black patients, but most of published cases have been reported in a non-African country [3]-[9].

Our study aim was to describe the diagnostic and therapeutic aspects of Senegalese patients living in Senegal, affected by IS secondary to a CW.

2. Patients and Method

This was a preliminary retrospective and prospective observational study, which was conducted over 12 months (April 2020-March 2021), at the Neurology department of Fann Teaching Hospital (Dakar-Senegal). Patients were recruited through the post-stroke neurovascular registry. Patients with ischemic stroke before the beginning of the study, were called for a re-reading or to perform an angioCT-scan of the cervical arteries in order to identify an unrecognized CW. Prospectively included patients had systematically an angioCT scan to detect a potential WC.

The diagnosis of symptomatic CW was confirmed if it was homolateral to the cerebral ischemic lesion, in the absence of ischemic sequelae in other vascular territories and of any other evident cause after an adapted minimal etiological evaluation including cardiac, vascular and biological examinations (**Table 2**). Patients were excluded if their imaging was not of good quality.

Epidemiological, clinical, radiological, therapeutic, and outcome characteristics were collected in Microsoft Office Excel® 2019. The National Institute of Health Stroke Scale (NIHSS) and modified-Rankin Scale (mRS) scores at 3 months were used to assess IS severity and functional disability, respectively. The means, standard deviations, and medians were calculated with Epi Info 3.5.4 software. Medical record confidentiality and patient identity were strictly respected.

3. Results

Between April 1, 2020, and March 31, 2021, 6 cases of CW were collected, causing left sylvian infarction in 4 patients (67%) and right in 2 others (33%). CW

was unilateral in 3 patients and bilateral in 3 others. The clinical and radiological characteristics of the patients are summarized in Table 1, Figure 1 and Figure 2.

The average age of the patients at the ischemic stroke diagnosis was 41 ± 6 years and the median age was 43 years (32 - 46) with a sex ratio of 1. The average time to CW diagnosis was 13 months with extremes of 1 day and 33 months. Half of the patients had no known vascular risk factors before the neurovascular event. One patient was a smoker, one had essential hypertension, and one was obese. The mean initial NIHSS was 15 ± 6 (8 - 22). Half of the patients had a severe infarction (NIHSS ≥ 15). The etiological workup performed for each patient is listed in Table 2. On admission, the mean LDL cholesterol level was 1.52 g/L ± 0.49.

None of the patients had received intravenous thrombolysis or later radical CW treatment (endarterectomy or carotid stenting). For secondary prevention, half of the patients were treated with aspirin and the other half with acenocoumarol. Two angio CT-scan were performed in four patients (67%). After a mean

Table 1. Clinical and radiological characteristics of the 6 Senegalese carotid web cases.

N°	Age	Sex	VRF	prev stroke	Time of stroke	i NIHSS	Territory	Angio 1	Angio 2	Diag delay	Lat	LDL	Antith	Rad	mRS	Follow up	Rec
1	46	F	HTA	no	08/2017	10	L Sylvian	yes	yes	33Mo	B	1.62	Asp	No	1	40	no
2	45	F	-	no	09/2017	8	R Sylvian	yes	no	33Mo	U	1.11	Asp	No	1	39	no
3	45	M	-	no	07/2019	11	R Sylvian	yes	yes	15Mo	U	1.4	Asp	No	1	17	no
4	42	M	Tobacco	no	05/2020	22	L Sylvian	yes	yes	11d	B	2.47	Acen	No	2	7	no
5	32	M	-	no	09/2020	19	L Sylvian	yes	yes	1d	U	1.24	Acen	No	3	3	no
6	36	F	Obesity	no	02/2021	22	L Sylvian	yes	no	1d	B	1.29	Acen	No	3	2	no

F = female; M = male; VRF: vascular risk factor; Mo = month; d = days; Asp = aspirin, Acen = acenocoumarol; mRS = modified Rankin score; i NIHSS = initial NIHSS; Angio:angio CT-scan of cervical arteries; diag = diagnosis; Antith: antithrombotic; Rad = radical treatment; Rec = recurrence; prev stroke = previous stroke; Lat = laterality; B = bilateral; U = unilateral; R = right; L = left. Age is expressed in years; follow-up time is expressed in months; LDL level is expressed in g/L.

Table 2. Laboratory, cardiac and vascular investigations performed in the 6 patients enrolled.

N°	Cardiac and vascular exams	Laboratory investigations
1	ECG, TCU, ED, angio	CBC, SV, CRP, PL, PTT, transaminases, urea, creatinine, FGL, lipids, RS, SS
2	ECG, TCU, ED, angio	CBC, SV, CRP, PL, PTT, transaminases, urea, creatinine, FGL, lipids, RS, SS, AA, APL
3	ECG, TCU, angio	CBC, SV, CRP, PL, PTT, transaminases, urea, creatinine, FGL, lipids, RS, SS, LP
4	ECG, TCU, ED, angio	CBC, SV, CRP, PL, PTT, transaminases, urea, creatinine, FGL, lipids, RS, SS, AA
5	ECG, TCU, 24 h ECG holter, angio	CBC, SV, CRP, PL, PTT, transaminases, urea, creatinine, FGL, lipids, RS, SS, LP
6	ECG, TCU, 24 h ECG holter, angio	CBC, SV, CRP, PL, PTT, transaminases, urea, creatinine, FGL, lipids, RS, SS, AA, APL

ECG = Electrocardiography; TCU = Transthoracic cardiac ultrasound; ED = Echodoppler of the neck arteries; Angio = Angio CT-scan of the neckarteries; CBC = complete blood count; C-reactive protein; SV = sedimentation velocity; PL = prothrombin level; PTT = Activated partial thromboplastin time; FGL = fasting glucose levels; RS = retroviral serology; SS = syphilitic serology; AA = antinuclear antibodies; APL = antiphospholipid antibodies; LP = lumbar puncture.

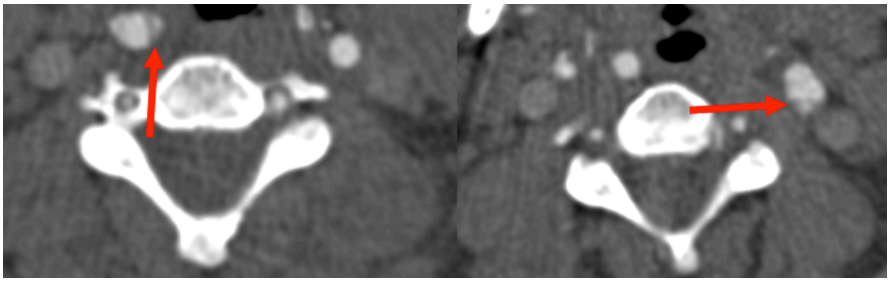

Figure 1. Cervical arteries angio CT-scan on axial view of patient 6 showing a bilateral carotid web with an "hamburger sign" aspect (red arrows).

Figure 2. Cervical arteries angio CT-scan on sagittal view of patient 6 showing a posterior bulbar filling defect (red arrows).

follow-up time of 18 ± 17 months (2 - 40), the mean mRS score was 2 ± 1 (1 - 3). No clinical ischemic recurrence was observed.

4. Discussion

The worldwide prevalence of CW is higher in countries with a majority of African descendants [4] [5] [6] [8] [9] [10]. Therefore, this prevalence could be similar or even higher in sub-Saharan Africa where stroke has a significant socioeconomic impact by affecting younger subjects than in developed countries [11]. In the literature, we did not find any clinical cases or series of patients with CW published in sub-Saharan Africa. A case of internal carotid artery dissecting aneurysm secondary to focal dysplasia has been reported in Côte d'Ivoire [12]. Thus, we report the first CW series in sub-Saharan Africa. It concerns 6 cases of ischemic stroke in young subjects for whom no other cause was identified apart

from a web-carotid, despite a first-line etiological investigation that was well conducted in our work context.

More and more, CW is recognized as a cause of IS, mainly if it occurs in a relatively young person, with few or no vascular risk factors, like in our series [4] [5] [6] [8] [9] [10] [13] [14] [15]. However, we did not find a female predominance, in contrast to what is commonly described in the literature [16].

The relative rarity of CW is due to the fact that it is most likely under diagnosed because of its potentially misleading morphology and the lack of familiarity of clinicians and radiologists with this carotid disease. It is responsible for ipsilateral recurrent IS despite the use of anti-platelet aggregation [5] [17]. Its diagnosis is therefore the key to effective secondary prevention.

The angio CT-scan of cervical arteries has the advantage of allowing a fine analysis of the lesion on the three views (sagittal, coronal and axial). It is on the axial views that the web appears as a complete cleavage of the lumen, thus separated into 2 parts on either side of the membrane. This is a specific sign of CW, named "hamburger sign" by some authors [15].

In our series, 4 patients had, during their follow-up, two angio CT-scan. For the first two, included retrospectively, this permitted us to diagnose an unrecognized carotid web, mistaken for an atheromatous plaque on the first study. For the other three, included prospectively, it was an investigation requested as part of the radiological control after some months of anticoagulation, in the hope of better visualizing the lesion. The young age, the absence of vascular risk factors, the presence of a contralateral CW, a homolateral ischemic stroke sequela and the absence of atheroma in the other vascular axes are the usual arguments in favor of the CW diagnosis.

Therapeutically, only radical treatment by endarterectomy or stenting would be definitively efficient without ischemic recurrence or postoperative complications [4] [9] [18]. In Senegal, only endarterectomy is performed, so far only for symptomatic atheromatous carotid stenosis. For secondary prevention, all 3 patients prospectively included were on acenocoumarol. Our therapeutic attitude could be justified by the lack of radical treatment and by the pathophysiological mechanisms underlying arterio-arterial embolization during CW [13] [16] [19] [20].

Our study has several limitations including the very small population size and the lack of histological evidence of CW. In additional, the mean follow-up over 18 months is relatively short to detect all possible IS recurrences, particularly as 3 patients were diagnosed prospectively, with a maximum 2 months follow-up. Thus, further studies with more patients and longer follow-up are ongoing.

5. Conclusion

At the end of this preliminary study, which is ongoing, we confirm that CW is an unrecognized cause of IS in young black patients. It is crucial to make the diagnosis early and to propose an adequate multidisciplinary management in or-

der to reduce the risk of recurrence, which is usually fatal.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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