⊕ OPEN ACCESS

Internal Medicine

Stroke in Young Subjects at the Hospital of Mali

Nouhoum Ouologuem[1*], Bakary Fofana[2], Seybou H. Diallo[3], Moussa Djimde[2], Fanta Dembele[1], Zoumana Traore[1], Massama Konate[1], Sow Djeneba Sylla[1], Bakari Dembele[1], Madani Ouologuem[4], Youssoufa Maiga[3]

[1]Department of Internal Medicine, Hospital of Mali, Bamako, Mali
[2]Malaria Reseach and Training Center, Faculty of Pharmacy - USTTB, Bamako, Mali
[3]Department of Neurology, Gabriel Toure Hospital, Bamako, Mali
[4]Army's Health Service, Bamako, Mali

Abstract	Original Research Article

Introduction: Stroke is the second leading cause of death worldwide. In Mali, very few studies have been carried out on stroke in young subjects. Nowadays, stroke is increasingly seen in young subjects. Hence the need to identify risk factors in order to adopt appropriate preventive measures. ***Method***: We carried out a retrospective descriptive study in the internal medicine department at the Hospital of Mali in Bamako from January 1 to December 31, 2022, in patients admitted for stroke confirmed by brain imaging (Scanner or Nuclear magnetic resonance imaging). Sociodemographic characteristics, medical history and biological parameters were recorded and analyzed to identify risk factors in patients aged 15-45 years. ***Results***: A total of 44 patients out of a total of 446 hospitalized in the department were analyzed, of whom 31.8% (15/44) were young subjects. The majority (71.42%) had ischemic stroke compared with 14.28% with hemorrhagic stroke. The difference was statistically significant ($p<0.001$).Hypertension was the most frequent vascular risk factor compared with elderly subjects ($p=0.045$). Other risk factors such as obesity and smoking were also associated with young age with an Odd Ratio (OR) of 3.25 and 2.0 respectively; however, these associations were not statistically significant ($p>0.05$). The main causes of stroke in young subjects were atherosclerotic plaques and emboligenic heart disease. Undetermined causes accounted for 40.1%. ***Conclusion***: Stroke prevention in young subjects involves screening for risk factors, especially hypertension. The vital prognosis depends on the cause of the stroke, but the functional prognosis remains better than that of the elderly.
Keywords: Stroke in young subjects, risk factors, causes, mortality.

1. INTRODUCTION

Stroke continues to be a major public health problem, with a high mortality rate and an enormous cost in terms of treatment. In 2016, around 14 million strokes were recorded worldwide, resulting in 5.5 million deaths [1]. It is estimated that almost 80% of strokes will occur in low- and middle-income countries by 2030 [2].

The young productive age group is increasingly affected, particularly in developing countries [3]. There is no official definition of the age of youth, but stroke in young subjects can be defined as stroke affecting adults in the 15-49 age group [4], which can have devastating consequences on the quality of life, the ability to work, to plan or run a family and to participate in social life [5].

According to WHO, stroke and cardiovascular disease will be the main challenges facing healthcare systems in developing countries in the near future [6]. The WHO report [7] estimated that the number of deaths among young subjects is relatively high in developing countries. Just over 30% of deaths occur at this age, compared with 20% in rich countries. This large number of premature deaths in poor countries is a serious public health problem. Stroke is one of the main causes of premature death in developing countries [8]. In Mali, very little work has been done on stroke in young subjects and the identification of risk factors. With a view to contributing to better management of this condition, we decided to determine the incidence of stroke in young subjects, identify the main associated risk factors, etiologies, and in-hospital mortality.

2. METHODS

We conducted a retrospective descriptive study in the internal medicine department at the Hospital of Mali in Bamako over a 12-month period. Our target population involved patients admitted for stroke confirmed by brain imaging (Scanner or Nuclear magnetic resonance imaging). All male and female patients aged between 15 and 45 years were included in the study. Sampling was based on consecutive recruitment of patients meeting the eligibility criteria.The data collected was recorded in a pre-tested questionnaire. Data were collected on socio-demographic characteristics: age, sex, occupation, residence, marital status; medical history in search of known FRCVs preceding the onset of the stroke: hypertension, diabetes, dyslipidemia, alcohol and/or tobacco consumption, stress, sedentary lifestyle, emboligenic heart disease documented by ECG or cardiac Doppler ultrasound. Clinical data included assessment of consciousness using the Glasgow score, measurement of systolic blood pressure (SBP) and diastolic blood pressure (DBP), and cardiac auscultation. Pulse palpation, oxygen saturation, meningeal signs, stroke severity using the NIHSS score.

Biological data were collected, including blood glucose, total cholesterol, HDL, LDL, blood ionogram, creatinine and glomerular filtration rate (GFR), microalbuminuria, HIV serology, PT/TCA, CBC, uric acid assay and dilated fundus examination to assess ocular impact. CT scan data were used to determine the type of stroke (ischemic or hemorrhagic). All patients underwent a cardiovascular check-up, including an electrocardiogram, transthoracic Doppler ultrasound and supra-aortic Doppler ultrasound. Other tests were carried out depending on the clinical context (Holter rhythm, HbA1C, causes: atherosclerosis, emboligenic heart disease, coagulopathies, cervico-encephalic artery dissections and others for cerebral ischemia. For hemorrhagic stroke, we had hypertension, arteriovenous malformations, blood crash disorders and others. Information on favorable disease progression and hospital deaths was also recorded. The data were entered using Access software and analyzed using *Stata version 14.2*.

3. RESULTS

During the 12-month study period, 446 patients were hospitalized, including 14 for stroke in young subjects. Ten had ischemic stroke and 4 had hemorrhagic stroke. The mean age for strokes in young subjects was 35.3±9.6, with extremes ranging from 16 to 45 years. The sex/ratio was 1. Epidemiological parameters and incidences are detailed in Table I.

In all 14 patients, hypertension was the most frequent vascular risk factor compared with elderly subjects (p =0.045). Elderly patients who were obese and smokers were three and two times more likely to have an ischemic stroke than younger subjects. For diabetic patients, the difference was not statistically significant. The distribution of vascular risk factors in patients with ischemic stroke is shown in Table II.

Among the causes of ischemic stroke, carotid atherosclerotic plaques (29.5%) followed by emboligenic heart disease (20.5%) were the major causes, while the vast majority were of undetermined cause (40.1%).

The etiology of ischemic stroke is reported in Table III. Stroke mortality in hospitalized young subjects was 14.3% lower compared with 16.6% in the elderly (Table IV).

Table I: Epidemiological characteristics of patients

	Ischemic stroke	Hemorrhagic stroke	Total
Overall incidence 95 % CI	7.4 cases/ 100 inpatients (5.1 -10.2)	2.5 cases/ 100 inpatients (1.2 -4.4)	9.9 cases/ 100 inpatients (7.3 -13.02)
Incidence in young subjects 95 % CI	22 cases/1000 inpatients (13.8 -33.1) (n=10)	9 cases/ 1000 inpatients (4.1–17.0) (n=4)	31 cases/1000 inpatients (21.2 -43.7)
Young averageage +SD	34.2+9.97	38.0+ 9.2	35.3±9.6
[Extremes;median]	[16 –45 ; 35]	[25 – 45 ; 41]	[16 –45; 38.5]
Sex ratio (Female/Male)	1.5	0.33	0.76

Table II: Stroke risk factors in young subjects

Risk factors	OddRatio	95% CI	P values
Sex	1	.18 - 5.9	0.963
Hypertension	.137	.017 - 1.1	0.045*
Diabetes	.67	.078 - 5.76	0.716
Obesity	3.25	.48 - 22.04	0.227
Smoking	2	.18 - 20.5	0.579
Dyslipidaemia	.63	.09 - 4.28	0.636
Family history of stroke	.181127	.0117868 2.78337	0.220
Chronicalcoholism	.396722	0184393 8.535	0.555

Table III: Etiologies of stroke in the study population

Causes	N (44 ; %)	Percentage (%)
Emboligenic heart disease	9	20.5
Coagulopathies	4	9.1
Atherosclerotic plaques	13	29.5
Undetermined causes	18	40.1

Table IV: Overall and specific mortality in the study population

	Overall mortality		Specific mortality	
	Frequency	Percentage		
Living	37	84.1	Adults (n, %) : 25. 67,6% Young subjects (n %) : 12.**32,4 %**	
Deceased	7	15.9	Adults (n, %) : 5.71,4% Young subjects (n %) :2.**28,6%** Young subject OM: (2/14) :**14.3%** Adult OM(5/30) :**16.6%**	*P= 0.451*
Total	44	100		

4. DISCUSSION

Our study determined the incidence, main risk factors, types of strokes and in-hospital mortality due to stroke in young subjects.

The annual incidence of all strokes admitted to the department was 9.99 cases/100 inpatients. The annual incidence of all ischemic strokes and hemorrhagic strokes combined in young people was 30.9/1000/year. This rate is significantly higher than the 9.68/100,000/year reported in 2002 by R. Deschamps *et al.*, [8] but comparable to that of Kittner *et al.*, [21] in 1993 in African Americans, who reported an incidence of around 30/100 for ischemic strokes and hemorrhagic strokes combined [9]. Our incidence figures reflect the reality within our population, as the Hospital of Mali is the only 3rd referral hospital on the right bank of the river in Bamako. In the ERMAN-CIA epidemiological study [10] carried out over one year, the number of ischemic stroke cases in young subjects was 13, which corresponds to the annual rate of inclusion in the present study. The epidemiological profile of our patients is consistent with that usually described in the literature, with an average age of 35 years and a sex ratio of around 1 [11-14]. In our series, 60% were in the 30-45 age group, a rate comparable to the 51.28% reported by Mapoure in Cameroon [14] (p=0.56).

The mean age at onset of hemorrhagic stroke was 38 years and that of ischemic stroke was 34.2 years. Balogou *et al.*, [15] found 36.5 years for hemorrhagic strokes compared with 39 years for ischemic strokes. Mapoure [14] reported 38.57 years for hemorrhagic strokes and 38.09 years for ischemic strokes. The majority of patients (57.14%) were cared for by their families, but 35.71% of patients had health insurance and only 7.15% had a very high standard of living. Given that the cost of treating a stroke is very high, the average hospital charge in Mali is 444,614 FCFA, equivalent to 12 times the minimum wage. Mapoure *et al.*, [14] in Cameroon show that stroke in young subjects is a burden on family economies because it occurs in subjects of productive age. The frequency of hemorrhagic stroke in our population was clearly correlated with the presence of hypertension compared with elderly subjects (p=0.045). Thus, all our patients suffering from hemorrhagic stroke were hypertensive. These results were comparable to those of other African authors [15, 16] but significantly higher than those found in Korean patients (38.3%) [17]. Elderly patients who smoke and are obese are two and three times more likely to have an ischemic stroke than younger subjects. Shinton *et al.*, [22] had shown that chronic tobacco smoking was associated with an increased risk of stroke. This risk diminishes significantly once smoking ceases. Even in isolation, smoking is a major risk factor for cerebral ischemia, with a relative risk of 2.5. Smoking promotes atheromatous lesions in cervical vessels and thrombus formation. The burden of diabetes was low, comparable to that observed in Asian and African American patients, at 10.1% respectively [17].

The etiological investigation showed that atheromatous causes of ischemic strokes were present in 29.5% of cases, followed by emboligenic heart disease in 20.5%. The vast majority were of undetermined cause (40.1%). No etiology was identified in 40% of our patients, mainly because of the inadequacy of our technical facilities, which made certain investigations difficult: the Holter ECG, trans-oesophageal echography and thrombophilia tests were not systematically performed. Our figures are lower than the 50% reported by Mapoure *et al.*, (16), the 55% in the American series [18] and the 57% in the Indian series [19].

The overall stroke mortality was 14.3%. This mortality was lower than the 26.92% found by Mapoure in Cameroon [14], the 21% in Burkina-Faso [15], and 23.9% in a Nigerian series [16], although these did not include severe strokes admitted to the intensive care unit. Bougousslavsky [20] obtained a mortality rate of

between 1.5% and 7.3%. The mortality rate in our series and in other African studies is higher than in European series due to medical transfer to a specialized department with a good level of technical support, and early and appropriate management in European countries.

5. CONCLUSION

Preventing stroke in young subjects requires early detection of vascular risk factors, particularly hypertension. The vital and functional prognosis is better than in the elderly. Active management in specialized units is an asset in reducing the mortality and functional disability associated with this dreadful disease.

REFERENCES

1. Global Burden of Diseases (GBD). (2019). GBD 2016 Stroke Collaborators. Global, regional, and national burden of stroke, 1990-2016: asystematicanalysis for the Global Burden of Disease Study 2016. *Lancet Neurol*, 18, 439-458.

2. Lopez, A. D., & Mathers, C. D. (2006). Measuring the global burden of disease and epidemiological transitions: 2002-2030. *Ann Trop Med Parasitol*, 100, 481-99.

3. Feigin, V. L., Krishnamurthi, R. V., Parmar, P., Norrving, B., Mensah, G. A., & Bennett, D. A. (2015). GBD 2013 Stroke Panel Experts Group. Update on the global burden of ischemic and hemorrhagic stroke in 1990-2013: the GBD 2013 study. *Neuroepidemiology*, *45*(3), 161-176.

4. Putaala, J., Metso, A. J., Metso, T. M., Konkola, N., Kraemer, Y., & Haapaniemi, E. (2009). Analyse de 1 008 patients consécutifs âgés de 15 à 49 ans ayant subi un premier AVC ischémique: le registre des jeunes AVC d'Helsinki. *Journal des accidents vasculaires cérébraux et des maladies cérébrovasculaires*, 40, 1195-1203.

5. Rutten-Jacobs, L. C., Maaijwee, N. A., Arntz, R. M., Van Alebeek, M. E., Schaapsmeerders, P., Schoonderwaldt, H. C., ... & de Leeuw, F. E. (2011). Risk factors and prognosis of young stroke. The FUTURE study: a prospective cohort study. Study rationale and protocol. *BMC neurology*, *11*(1), 1-8.

6. OMS/WHO. (2003). Rapport sur l'état de santé dans le monde 2003: Façonner l'avenir. Genève. OMS, 203p.

7. Osuntokun, B. O. (1993). Epidemiology of neurology illness in Africa. Presentation at tropical neurology symposium. March 26, 1993. London.

8. Deschamps, R., Olindo, S., Cabre, P., Elysée, S., Fournerie, P., & Smadja, D. (2004). Accident vasculaire cérébral chez le jeune Afro-Caribéenen Martinique: étude prospective épidémiologiqueet étiologique. *Rev Neurol (Paris)*, 160(3), 313-319.

9. Kittner, S. J., McCarter, R. J., Sherwin, R. W., Sloan, M. A., Stern, B. J., Johnson, C. J., ... & Price, T. R. (1993). Black-white differences in stroke risk among young adults. *Stroke*, *24*(12 Suppl), I13-5.

10. Smadja, D., Cabre, P., May, F., Fanon, J. L., René-Corail, P., Riocreux, C., ... & ERMANCIA Study Group. (2001). ERMANCIA: Epidemiology of Stroke in Martinique, French West Indies: Part I: methodology, incidence, and 30-day case fatality rate. *Stroke*, *32*(12), 2741-2747.

11. Nencini, P., Inzitari, D., Baruffi, M. C., Fratiglioni, L., Gagliardi, R., Benvenuti, L., ... & Rosselli, A. (1988). Incidence of stroke in young adults in Florence, Italy. *Stroke*, *19*(8), 977-981.

12. Giroud, M., Beuriat, P., VIon, P., D'athis, P. H., Dusserre, L., & Dumas, R. (1989). Stroke in a French prospective population study. *Neuroepidemiology*, 8, 97-104.

13. Rozenthu, L., Sorokin, N, Ronen, R., Tamir, A., Geva, H., & Eldar, R. (1996). Stroke in the young in Israel: incidence and outcomes. *Stroke*, 27, 838-841.

14. Mapoure, Y. N., Essissima, M. F., Ba, H., Ngahane, B. H. M., Beyiha, G., Luma, H. N., ... & Njamnshi, A. K. (2016). Spectre des maladies cérébro-vasculaires chez le sujet jeune à Douala. *Pan African Médical Journal*, *23*(1), 250. doi:10.11604/pamj.2016.23.250.7102

15. Balogou, A. A. K., Grunitzky, E. K., & Assogba, K. (2008). Accidents vasculaires cerebraux chez le sujet jeune (15-45ans) dansle service de neurologie du CHU campus de Lome. *African Journal of Neurological Sciences*, 27(2).

16. Owolabi, L. F., & Ibrahim, A. (2012). Stroke in young adults: a prospective study from northwestern Nigeria. *International Scholarly Research Notices*, *2012*.

17. Kwon, S. U., Kim, J. S., Lee, J. H., & Lee, M. C. (2000). Ischemic stroke in Korean young adults. *Acta Neurol Scand*, 101, 19-24.

18. Jacobs, B. S., Boden-Albala, B., Lin, I. F., & Sacco, R. L. (2002). Stroke in the Young in the northern Manhattan. *Stroke Study*, 33, 2789-2793.

19. Dash, D., Bhashin, A., kumar Pandit, A., Tripathi, M., Bhatia, R., Prasad, K., & Padma, M. V. (2014). Risk factors and etiologies of ischemic strokes in young patients: a tertiary hospital study in north India. *Journal of stroke*, *16*(3), 173-177.

20. .Bogousslavsky, J, & Pierre, P. (1992). Ischemic stroke in patients under age 45. *Neurol Clin*, 10, 113-124.

21. Kittner, S. J., McCarter, R. J., Sherwin, R. W., Sloan, M. A., Stern, B. J., Johnson, C. J., ... & Price, T. R. (1993). Black-white differences in stroke risk among young adults. *Stroke*, *24*(12 Suppl), I13-15.