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Risk of Stroke in Children at the Kamenge University Hospital Center

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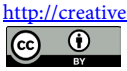

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Abstract

Aim: This study aimed to determine the risk factors for stroke in children hospitalized at the Kamenge University Hospital Center for a motor deficit of the limbs. **Patients and methods:** This was a descriptive and retrospective study conducted from January 1, 2010 to December 31, 2019 in the Department of Pediatrics at the Kamenge University Hospital Center. All records of children under 15 years who were hospitalized for a motor deficit of the limbs, isolated or not, for which the diagnosis of stroke has been made and with a complete medical record were included. **Results:** The study involved 15 patients including 9 boys and 6 girls. The average age was 48 months (4 years). The stroke occurred due to a pre-existing chronic pathology acquired or not in 73.3% of cases. In addition to hemiplegia, the other neurological signs found were mainly aphasia (73.3%) and convulsions (40%). Brain scanning could only be performed in 53.3% of cases. The main risk factors highlighted were pre-existing chronic pathologies such as sickle cell disease (40%), congenital or acquired heart disease (26.6%) and retroviral infection (13.3%). The evolution of deficit motor was favorable over a 3-month follow-up with complete regression in 93.3% of cases. **Conclusion:** Stroke is a rare condition in children. It often occurs on a pre-existing chronic pathology in the majority of cases. Sickle cell disease represents the greatest risk factor for childhood stroke in our context. Proper monitoring of children with chronic illnesses is essential for their survival.

Subject Areas

Pediatrics

Keywords

Risk Factors, Stroke, Child

1. Introduction

Cerebrovascular accident (CVA) is the development of localized or generalized clinical signs (as in subarachnoid hemorrhages) of cerebral dysfunction lasting more than 24 hours or leading to death, with no apparent cause other than a vascular origin [1]. Stroke in children is a rare but serious entity that is rarely considered immediately by emergency healthcare professionals; so, it often results in a diagnostic delay [2] [3].

Strokes in children differ from those in adults due to different risk factors, causes and vital and functional prognosis [4]. Stroke in children is poorly studied [5] [6], particularly in Burundi where no studies on childhood strokes have been found. The aim of our study was to highlight the risk factors for childhood stroke at the Kamenge University Teaching Hospital.

2. Material and Methods

This was a retrospective study of 15 patients admitted for stroke in the Department of Pediatrics at Kamenge University Hospital Center over a period of 10 consecutive years, from January 1, 2010 to December 31, 2019. All files of patients aged less than 15 years, who were hospitalized for a motor deficit of the limbs and whose diagnosis of stroke was based on clinical and/or paraclinical arguments were included. Stroke cases whose medical records were incomplete and/or unusable in relation to the variables of our study were excluded from the study. For each patient, we recorded data relating to age, sex, pre-existing defects, medical history, clinical signs, the nature of the biological or imaging examinations carried out and their results, the treatments administered during hospitalization and the outcomes.

3. Results

Epidemiological aspects

In our study, we collected 15 cases of stroke over a period of 10 years, *i.e.* an incidence of 1.5 cases/year. Stroke cases represented 0.125% of all pathologies encountered in the Department of Pediatrics.

The population of our study included 15 patients, *i.e.* 9 boys (62.5 60%) and 6 girls (40%) (**Figure 1**). The sex ratio was 1.5 in favor of boys, 60% of our patients were aged between 3 and 5 years. The average age was 48 months (**Table 1**).

4. Risk Factors

Underlying pathologies were found in 86.6% of our patients. These included sickle cell disease (40%), acquired or congenital heart disease (26.6%), HIV infection (13.3%) and lipoid nephrosis (6.7%). All of these children hardly benefited from regular monitoring for their chronic pathologies. In 13.3% of the cases, there was no known specific site found, but a recent history of chickenpox was noted in one case (6.7%).

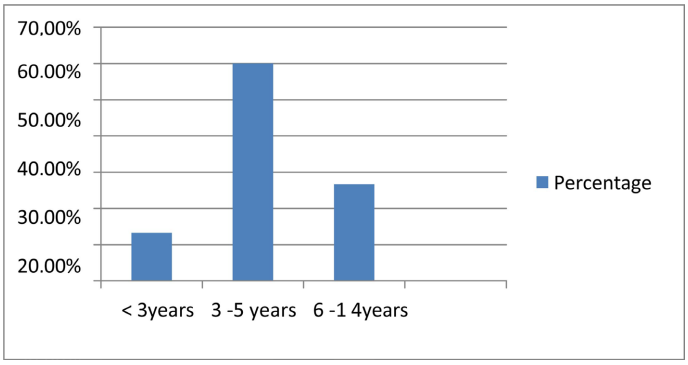

Figure 1. Distribution of patients by age.

Table 1. Distribution of patients according to sex.

Sex	Number	Percentage
Male	9	60%
Femele	6	40%

5. Diagnostic Aspects

5.1. Clinical Signs

The physical examination at admission was dominated by hemiplegia (93.3%), aphasia (73.3%) and seizures (53.3%). The neurological signs observed are presented in Table 1. Other signs related to the underlying pathologies were found. These include heart rhythm disturbances (40%), cyanosis (13.3%), pallor (33.3%) and splenomegaly (33.3%).

5.2. Paraclinical Data

For the positive diagnosis of stroke, the brain scan could only be carried out in 5 cases, *i.e.* a completion rate of 33.3% and it was an ischemic stroke in all 5 cases. It showed carotid involvement in three cases, of which two were left and one right; one occurred in the right vertebro-basilar territory; and one case was of mixed involvement (vertebro-basilar and carotid). The etiological research made it possible to carry out cardiovascular assessments including cardiac ultrasound and electrocardiogram with respective completion rates of 60% and 53.3%. Cardiac ultrasound revealed 2 cases of tetralogy of Fallot. The ECG revealed the existence of complications such as heart rhythm disturbances in a case of mitral disease.

5.3. Etiological Aspects

The etiologies highlighted were mainly thromboembolic complications in the context of pathologies such as sickle cell disease (40%), heart disease (30%), corticosteroid-resistant nephrotic syndrome with significant hypoalbuminemia (6.7%) and post-varicella angiitis (6.7%). The etiologies highlighted are listed in Table 2. The stroke made it possible to discover the unknown underlying

Table 2. Distribution of children according to clinical signs at admission.

Clinical signs	Number	Percentage
Hemiplegia	14	93.3
Language disorders (aphasia)	11	73.3
Seizures	6	40
Balance disorders	3	20
Headache	2	13.3
Hemiparesis	1	6.7
Unilateral blindness (right)	1	6.7

conditions in 5 patients including 3 cases of sickle cell anemia (20%) and 2 cases of congenital heart disease such as tetralogy of Fallot (13.3%).

5.4. Therapeutic and Evolutionary Data

Regarding the treatment, functional rehabilitation was practiced in 80% of patients by the physiotherapy service. In 2 patients (13.3%), the regression of the motor deficit was spontaneous. Other treatments were administered for either symptomatic or etiological management in certain cases. These included parenteral rehydration by ringer lactate infusions associated or not with abundant drinks (40%) and transfusion with packed red blood cells (20%) in sickle cell patients, heparin therapy (13.3%) and corticosteroid therapy (6.7%) for cases of nephrotic syndrome and anticonvulsants based on phenobarbital for cases of convulsions (26.7%) (See **Table 3**).

The evolution was marked by the occurrence of death in the acute phase in a sickle cell patient due to an infectious complication, and by an improvement on the neurological level with complete regression of the motor deficit for the other 14 cases (93 .3%) over a 3-month follow-up.

6. Discussion

6.1. Epidemiological Aspects

Stroke is a rare pathological entity in children [7], it is 10 to 20 times less common than in adults [5] [6]. Also in our series, the hospital frequency is only 1.5 cases per year. The incidence of childhood stroke varies greatly from one study to another. In a study conducted in Congo by Tohodjede Y *et al.* in 2018 [8], 16 cases were found over 10 years, while in 2015 Ndiaye M *et al.* in Senegal reported 73 cases over 10 years [9]. Sounga Bandzouzi P.E. *et al.* in 2021 in Pointe-Noire (Congo) listed 17 cases over a period of 35 months [10]. These dissimilarities between the incidences are due to methodological differences such as the multicenter nature or not, the retrospective or prospective nature and the means used for confirmation of the stroke.

The average age of stroke onset in our series is 4 years, the age group of 3 to 5 years being the most represented with 60% of cases. Bartolome AM, Pontigon

Table 3. Distribution of patients according to stroke etiologies.

Etiologies	Number	Percentage
Sickle cell anemia	6	40
HIV Infection	2	13.3
Congenital heart disease (Tetralogy of Fallot)	3	20
Heart disease (acquired (mitral disease)	1	6.7
Nephrotic syndrome	1	6.7
Complication of chickenpox	1	6.7
Undetermined causes	1	6.7

AM. and Moharir M. found two frequency peaks, one between 2 and 3 years and the other between 10 and 11 years [11]. Sounga Bandzouzi P *et al.* found in their study an average age of 11 years with the extremes of 7 to 15 years [10]. For the study by Tohodjede Y. *et al.* the average age of the patients was 8 years with extremes of 1 and 15 years [8]. These different results show that all ages can be affected by stroke. A male predominance is noted in most studies. In our series, this predominance was highlighted with a sex ratio of 1.5. Bournoussi W [12] in Morocco found 75% boys, *i.e.* a sex ratio of 3. A sex ratio of 2.2 was reported in the studies by Ndiaye in Senegal [9] and Ouchen in Morocco [13].

6.2. Risk Factors and Causes

The majority of our patients (73.3%) had a chronic pathology with little or no follow-up. In our context of a country with limited resources, patient monitoring poses problems due to the financial cost it involves (consultation costs, additional tests and medications while medical care coverage is exceptional). The underlying pathologies found in our patients were represented by sickle cell disease (40%), acquired or congenital heart disease (20%), HIV infection (13.3%) and chronic kidney disease (6.7%). Our results are consistent with the risk factors for ischemic stroke noted by other authors in the literature, namely cardiac causes, hematological causes (anemia and sickle cell anemia) and infectious causes such as retroviral infection [10] [14] [15].

Several authors report a predominance of hematological causes, notably sickle cell disease and anemia. Indeed, sickle cell disease is the most common cause of ischemic stroke in children with a risk approximately 300 times greater than in children of the same age without sickle cell disease. It causes cerebral vasculopathy [16] [17]. Heart disease represents a significant cause of stroke in children, it is found in 25% of cases [18]. Indeed, some of our patients (20%) had heart disease as other authors have reported [8] [9] [12] [13]. During our study, 13.3% of our children were HIV positive. As the literature says, HIV is among the viral infections that can cause cerebral angiitis responsible for cerebral infarction [19]. A specific type of cerebral vasculopathy characterized by arterial ectasia and aneurysmal formation was first recognized in HIV-infected children and young adults as a cause of cerebral infarction and cerebral hemorrhage [20] [21]. Other

bacterial or viral infections in children can be complicated by cerebral angiitis responsible for cerebral infarction, the most common of which at this age is post-varicella angiitis which is characterized by necrotizing arterial damage [22]. In our patients, the stroke occurred after chickenpox in one case.

Nephrotic syndrome was one of the etiologies of childhood stroke implicated in our series (6.7%). Indeed, a risk of thromboembolic complications exists in the case of nephrotic syndrome but its incidence is far lower in the pediatric population [23]. It would be around 3% [24].

6.3. Diagnostic Aspects

At admission, hemiplegia was the dominant sign (*i.e.* in 93.3% of cases) in our study. It was associated or not with other signs such as aphasia (73.3%), convulsions (40%) and headaches (13.3%). The frequency of hemiplegia is noted by other authors [6] [10] [24] at 62%, 53% and 82.6% respectively. The same signs of stroke were also noted by Souga *et al.* [10] but in proportions different from ours (hemiplegia, language disorder, convulsions and headaches), respectively in 53%, 53%; 11.7% and 29.4% of cases. Barnoussi in Morocco in 2014 noted in his study of 8 cases, aphasia in 3 children and an altered state of consciousness with convulsive seizures in 2 other patients [12]. Concerning the positive diagnosis of stroke, the brain scan could only be performed in 33.3% of cases in our series. The diagnosis of stroke was based on anamnestic, clinical and evolutionary arguments for other cases. This low rate is linked to the high cost of this examination in a country where the average household income is low. But these were cases of ischemic stroke in all cases. Sounga's study also noted a predominance of ischemic stroke [10]. In Africa, several authors report a predominance of ischemic stroke and sickle cell disease remains the dominant etiology in the majority of cases [8] [14] [15]. But the literature and studies carried out on other continents highlight the predominance of hemorrhagic strokes in children where arteriovenous malformations are the main cause in 14% to 57% [22].

6.4. Therapeutic and Evolutionary Aspects

The management of chronic conditions is not easy in countries with limited resources. Still, socio-economic aspects can modulate the prognosis of chronic conditions by impacting their management [25]. In our study, it was not possible to determine by brain scan whether there was no case of hemorrhagic stroke. In the literature, children with ischemic stroke have a better prognosis than those with hemorrhagic stroke [6]. In Sounga's study, the majority of patients had fully recovered from their motor deficit and had no cognitive after-effects, but no neuropsychological test was carried out [10]. Under normal conditions, a child with a chronic illness requires regular and specialized monitoring involving numerous medical or paramedical specialists and the multidisciplinary consultation for these children with chronic illnesses has among other objectives the prevention and detection of complications or disorders associated with the

chronic pathology [25] [26]. In our series, all patients had recovered from their neurological deficit over a three-month follow-up except for the case of death which occurred in the acute phase. But the cognitive side had not been evaluated nor the search for recurrences beyond 3 months.

7. Conclusion

Stroke in children is a rare pathology in pediatric departments. Its diagnosis remains imprecise and its correct management is difficult in countries with limited resources. But, ischemic stroke remains the most common form. Risk factors are highlighted in the majority of cases and are dominated by sickle cell disease. Appropriate monitoring and management of chronic diseases in children at risk of thromboembolism would help prevent the occurrence of a large number of strokes.

Conflicts of Interest

No conflicts of interest regarding the publication of this paper.

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