Residência RP Pediátrica
Publicação Oficial da Sociedade Brasileira de Pediatria
ISSN-Online: 2236-6814

Submitted on: 07/14/2022
Approved on: 08/15/2022

ORIGINAL ARTICLE

Patients under 21 years old with a diagnosis of stroke admitted between 2005 and 2019 in the interior of São Paulo, Brazil

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Keywords:
Stroke,
Child,
Adolescent,
Risk Factors,
Prevalence,
Epidemiology

Abstract

Introduction: The hospitalization rate of young patients affected by stroke has been increasing and tends to worsen if there is no improvement in socioeconomic and educational conditions, quality of hospital care and primary and secondary control of risk factors. **Objective:** To collect data and alert health professionals to the prevalence of stroke in children under 21 years of age, identify risk factors and their causes between 2005 and 2019, in a high complexity hospital in the western region of the state of São Paulo - Brazil. **Methods:** An analytical longitudinal retrospective study was carried out using data collected from the patients' medical records. **Results:** The prevalence of stroke in children under 21 years of age hospitalized in the period was 0.18%. Excluding the external ones, thrombosis was the most frequent cause of stroke and most patients (74%) had comorbidities and/or concomitant risk factors, such as the use of oral contraceptive, allergic diseases, hematopathies, heart diseases, hydrocephalus, central nervous system tumors and autoimmune diseases. **Conclusion:** These data should alert health professionals to the importance of early diagnosis, as the initial signs and symptoms are nonspecific and can be confused with other neurological diseases, while the complications and sequelae are long-lasting, sometimes lifelong, and need to be minimized.

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DOI: 10.25060/residpediatr-2023.v13n1-921

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INTRODUCTION

The cerebrovascular accident (CVA) is a worldwide public health problem, it causes disability, loss of healthy years of life and in several developing countries, including Brazil, it is one of the main causes of death[1,2]. Studies indicate that the hospitalization rate of young patients affected by this disease has been increasing worldwide and this situation tends to get worse if there is no improvement in socioeconomic and educational conditions, quality of hospital care and primary and secondary control of risk factors, from childhood[1-3]. Although the long-term clinical evolution is favorable in younger patients, pediatric stroke is a significant cause of death in this age group[4].

The annual incidence rates of pediatric stroke, including neonatal and childhood stroke, and ischemic and hemorrhagic stroke, vary from 3 to 25 per 100,000 children in developed countries[5], in Brazil these data are limited[6]. Among those affected, 7 to 14% die and up to 70% will present permanent morbidity[7-9]. These children will have deficits that profoundly impact their quality of life and their families, in addition, the burden to society is high, as the cost of post-stroke care is probably higher for a child than for an adult[10]. Thus, it is important for pediatric healthcare professionals to be alert to risk factors and be able to recognize stroke in patients of different ages and treat it early to preserve brain function and promote tissue repair and recovery[4,5].

The signs and symptoms of stroke, for example the neurological deficit, are not as evident in children as in adults, as a consequence, the possible etiology of the alterations presented by the patient may not be considered[11]. In this context, it becomes important to identify risk factors that may contribute to the diagnosis of stroke in children or young adults in order to adopt adequate treatment strategies[12]. The objective of this study was to collect data and alert healthcare professionals to the prevalence of stroke in children under 21 years of age, to identify risk factors and their causes between 2005 and 2019, at the Presidente Prudente "Dr. Domingos Leonardo Cerávollo" Regional Hospital (HRPP) - SP.

METHODOLOGY

This study is part of the scientific production of the Center for Technological Assessment in Health (NATS) of the Presidente Prudente Medical School (FAMEPP). It was approved by the HRPP Ethics Committee and by the Research Ethics Committee (CEP/COMEP system) of the University of Western São Paulo - UNOESTE, in Presidente Prudente – SP (CAAE: 28464819.8.0000.5515). It is registered on the Plataforma Brasil and was carried out in accordance with regulatory norms and guidelines for research involving human beings, Ordinance of the National Health Council (CNS), Resolution No. 196/96.

Study Design

We ran an analytical longitudinal retrospective study, using data collected from the medical records of patients treated at the outpatient clinic or who were hospitalized in the different sectors of the HRPP, between 2005 and 2019.

Population of Interest and Inclusion Criteria

Based on the Statute of Children and Adolescents, Law 8069, of 1990, which considers a child to be a person up to 12 years of age and defines adolescence as the age group from 12 to 18 years of age (Article 2), and, in exceptional cases and when provided by law, the statute is applicable up to 21 years of age[13], patients aged less than 21 full years were included, without gender restriction and who were diagnosed with ICD (International Classification of Diseases) between I 60 and I 69.

Exclusion criteria

Records with ICD between I 60 and I 69 outside the established period (2005 to 2019) and records of patients with stroke caused by external causes were excluded from the statistical analyses.

Statistical analysis

The percentage data were submitted to the binomial test for two proportions. Frequency data were submitted to the chi-square test when they were separated into two categories and to the Kruskal-Wallis test when they had more than two categories. The software used to assist in the analyzes was the RStudio version 1.1.453, and the significance level adopted in the tests was 5%.

RESULTS

Prevalence of stroke

In total, 51,245 patients were admitted to the HRPP between 2005 and 2019, and according to the medical records, 92 of these were aged between 0 and 21 years and were diagnosed with stroke, classified with ICD - 10 of I60 to I69 (Figure 1). These numbers show that the prevalence of stroke in children under 21 admitted to the HRPP in the period was 0.18%.

Causes of stroke by age group, comorbidities and risk factors present

TBI was the most frequent cause of stroke (41 cases), according to the medical records. For not contemplating the objective of this study, the cases of CVA due to external factors, the profile of the patients and the risk factors were not included.

Excluding external ones, thrombosis was the most frequent cause of stroke (13 patients). Of this total, 10 patients were aged between 12 and 21 years. The age group with the highest number of stroke occurrences was between 12 and 21 incomplete years, in patients younger than 1 year we

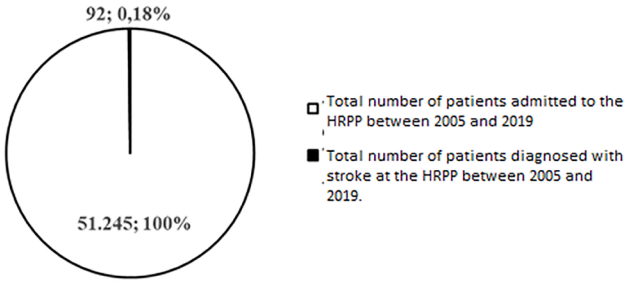


Figure 1. Prevalence of stroke in the HRPP between 2005 and 2019.

identified 11 stroke diagnoses. All data highlighted above are shown in Table 1.

Most patients (74%) had comorbidities and/or risk factors, concomitant or not, which may be related to the causes of the stroke that were recorded in the medical records (Table 2). Among them, we highlight the use of OAC by seven patients (one of whom smokes and one obese), seven cases of allergic diseases, six of hepatopathies, four of heart diseases, three of hydrocephalus, two of CNS tumors and two of autoimmune diseases.

AVM: Arteriovenous malformation; PO: Postoperative; CNS: Central Nervous System; ACO: Oral Contraceptive. + Interatrial Communication (2 cases), Myocarditis (1 case)

Table 1. Causes of stroke by age group in patients under 21 admitted to the HRPP between 2005 and 2019.

Causes	**Age range**					
	< 1	**≥ 1 < 12 meses**	**≥ 01 < 07 anos**	**≥ 07 < 12 anos**	**≥ 12 < 21 anos**	**Total**
month	≥ 1 < 12 months	≥ 01 < 07 years	≥ 07 < 12 years	≥ 12 < 21 years	Total	**11**
Idiopathic	02			02	07	**11**
AVM			01	02	03	**06**
PO complications			03		06	**09**
Prematurity	03					**03**
Neonatal anoxia	02					**02**
Thrombosis		02	01		10	**13**
Vasculitis					01	**01**
Cavernoma					01	**01**
Anemia			01			**01**
Aneurism					02	**02**
Intrauterine CVA	01					**01**
Moya Moya		**01**				01
CVA Total						41
By age range	07	04	06	04	30	
Head injury						**41**
						92

AVM: arteriovenous malformation; PO: Postoperative; CVA: Cerebral Vascular Accident; TBI: Traumatic Brain Injury.

and Valve Insufficiency (1 case); * Sickle cell anemia (3 cases), Protein S Deficiency, Thalassemia and Thrombotic Thrombotic Thrombocytopenic Purpura (1 case each).

Pediatric History

The number of patients who had stroke with a family history of illness did not differ statistically (p = 0.81) from those who had no family history of illnesses. The analysis of data from the obstetric and perinatal history of the patients showed that 58.8% of the mothers received prenatal care, most patients (69%) were born at term, by Cesarean delivery without perinatal complications and in the APGAR test, 80% of patients had a score greater than seven, the chi-square test showed no significant difference for these variables (p= 0.32).

Table 2. Comorbidities and/or risk factors related to the causes of stroke.

Comorbidity /Risk Factor	CAUSES						
	Idiopathic	AVM	PO complications	Thrombosis	Vasculitis	Anemia	Aneurism
Cardiopathies+	2			2			
Hematopathies*	3			1		1	1
Brain aneurysm	1						
CNS malformation	1			1			
Hydrocephaly			2	1			
Allergies	2	2		3			
Use of OC				7			
Obesity				3			
CNS tumor				1			
Autoimmune diseases				1	1		
Chronic headache	1			1			
Nasoangiofibroma			1				
Smoking				1			

AVM: Arteriovenous malformation; PO: Postoperative; CNS: Central Nervous System; ACO: Oral Contraceptive. + Interatrial Communication (2 cases), Myocarditis (1 case) and Valve Insufficiency (1 case); * Sickle cell anemia (3 cases), Protein S Deficiency, Thalassemia and Thrombotic Thrombotic Thrombocytopenic Purpura (1 case each).

The Kruskal-Wallis test did not show statistical difference for height and birth weight of patients, they varied between 32 and 52 cm, and 829 to 4,345 g respectively.

DISCUSSION

The present study sought to identify the probable causes and risk factors that led children, adolescents and young people to stroke. These data will serve as a warning for healthcare professionals, especially physicians, to the prevalence that has increased in patients in these age groups and the importance of early diagnosis. In these patients, the initial signs and symptoms are nonspecific and can be confused with other neurological diseases, while the complications and sequelae are lasting, sometimes lifelong, and need to be minimized[9,14].

In the population studied, the prevalence of stroke was 0.18%, of which 21.6% were children under 1 year of age. These data corroborate the hypothesis that this morbidity deserves attention due to its sequelae, and also show that stroke has become an increasingly recognized cause of morbidity and mortality in children[15]. Epidemiological data on childhood strokes nationwide are limited in Brazil; however, studies with populations from different regions of the country and age groups similar to the focus of this study are compatible with those obtained in this study[6,16-18]. In the world, updated data on incidence and mortality show variation between countries with high and medium-low income and a slight tendency to increase deaths from stroke in younger age groups[19]. In the pediatric population, unlike the adult population, the etiologies of stroke are diverse[20].

The notes recorded in the patients' charts pointed to thrombosis as the most frequent cause of stroke. It is important to point out that in most cases this condition was observed in young female patients who were using OC. A systematic review points out that the risk of ischemic stroke increases twice in young women who use OC and even greater if these patients have chronic headache[21]. Note the registration of other important comorbidities [cardiopathies, hematopathies (mainly sickle cell anemia)], AVM, hydrocephalus, obesity and smoking]. Studies indicate that the incidence of stroke in children increases as the prevalence of important risk factors changes in this age group over time[15]. Congenital heart diseases and obesity are becoming more prevalent in children, as is tobacco use, in contrast, the prevalence of hematopathies has declined due to stroke prevention strategies in this population[22-24].

We found records of PO complications in 09 cases; the prevalence is higher in older patients. In most cases, complications culminated in ischemic stroke after various procedures (placement/replacement of peritoneal ventricular shunt system, resection of intra or extra CNS tumor, appendectomy and inguinal hernia repair). In the literature, reports indicate the incidence of PO cerebral infarcts ranging from 2.7% to 13% after surgical procedures[25-27]. These ischemic events can rapidly lead to permanent neurological deterioration[28].

The history of family disease, data from the obstetric and perinatal history of the patients, the gestational age, the number of mothers who underwent prenatal care and the patient's score on the APGAR test did not reveal statistical significance as a risk factor for the occurrence of CVA in the patients of this study. Current literature recommends carrying out a detailed obstetric investigation in very young patients who have had a stroke[29].

Unfortunately, the minority of the medical records analyzed had the pediatric questionnaire and the obstetric data completely filled out, and this fact made it difficult to correlate the occurrence of strokes in young people with the history of complications during pregnancy and childbirth. We believe that the retrospective characteristic of the methodology used in this study and the small sample of patients may have reduced its ability to find predictive significance for such factors.

CVA in childhood is little recognized by healthcare professionals, which makes diagnosis, etiological investigation and therapy difficult[14]. The low incidence of this disease makes it difficult to carry out clinical trials and make recommendations based on consistent evidence, as a consequence, most therapeutic recommendations result from the extrapolation of the results of studies carried out in adults and consensus of groups of specialists[5,30].

The data presented, despite the low sample number, reinforces the importance of carrying out more studies that aim to relate the symptoms and risk factors, and point out the importance of a multidisciplinary organizational infrastructure aimed at therapies that aim to minimize the consequences of stroke in children and young people.

CONCLUSION

The prevalence of stroke in the studied population is low and thrombosis was the second most frequent cause of stroke in patients younger than 21 years of age. Most patients had comorbidities and/or concomitant risk factors. Despite a limited sample, this study reinforces the need for a high level of suspicion for childhood stroke, particularly in the presence of risk factors, as neurological sequelae are long-lasting and require long-term follow-up.

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