

Stroke in Iraqi children: Experience of Children Welfare Teaching Hospital

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Abstract

Background Stroke in childhood is serious disorder about which little is published.
Objective To determine demographic and presenting features of children with stroke.
Methods A cross sectional study was conducted on cases of pediatric stroke admitted to Children Welfare Teaching Hospital during May 2008-August 2011. Cases classified radiologically into ischemic and hemorrhagic types. Basic data and clinical presentation were gathered.
Results Sixty nine children (49 boys, 20 girls), aged 1 month-14 years were enrolled. Annual hospital admission rate was 54.2 /100000; boys:girls ratio was 2.5:1, girls were younger than boys. Ischemic stroke was found in 58% of cases. Patients with hemorrhagic stroke were younger than those with ischemic type. Those aged <1year account for 55.1% (82.8% of patients with hemorrhagic stroke) while half of those with ischemic type aged 1-5 years. The commonest presentation in both types was seizure, mostly among infants. About 2/3 of patients were from Baghdad.
Conclusion Stroke in children is more common among boys. Ischemic type is commoner than hemorrhagic. Those with hemorrhagic stroke tend to be younger than ischemic. The majority of children with hemorrhagic type present at age younger than one year. Seizure was the most common presentation in both types.
Key words Stroke; Iraqi children; Ischemic; Hemorrhagic

Introduction

Stroke is increasingly recognized as a cause of childhood disability and lifelong morbidity: population-based estimates of the annual incidence of childhood stroke (ischemic and haemorrhagic) range from 2.3 to 13.0 per 100,000 children and incidence rates in neonates are closer to 1 per 5000 live births⁽¹⁾. Stroke is among the top ten causes of death in children in United States⁽²⁾. Although considered rare by adult standards, stroke is more common in children than brain tumours. Subtypes include⁽³⁾:

- Arterial ischemic stroke (AIS)
- Cerebral sinovenous thrombosis (SVT).
- Haemorrhagic stroke (HS).

Childhood ischemic stroke can include both arterial ischemic stroke (AIS) and sinovenous thrombosis (SVT)⁽⁴⁾.

Stroke in childhood can have many causes. Diagnosis is often delayed owing to low clinical suspicion and the need to exclude the frequent mimics of stroke in childhood⁽¹⁾. Stroke in childhood has long been thought of as a rare and benign occurrence. However, advances in non-invasive neuroimaging have led to increased recognition of this disorder in children who might otherwise have received a diagnosis of hemiplegic cerebral palsy. Furthermore, the idea that children recover well from stroke has been contradicted by the results of outcome studies that show a high rate of lifelong morbidity: 10% of children who

have a stroke die; 20% have further stroke; and 70% have seizures or other neurological deficits. About a half of incident childhood strokes are ischemic, and the incidence is higher in boys than it is in girls⁽¹⁾.

The clinical presentation of stroke in children varies according to age, underlying cause, and stroke location. The most common presentations include hemiplegia and seizure in ischemic stroke, headache and vomiting in hemorrhagic stroke, and headache and decreased level of consciousness in children with cerebral venous thrombosis⁽⁵⁾.

The current study aimed to calculate the prevalence of stroke among patients admitted to Children Welfare Teaching Hospital / Baghdad-Iraq, to study some demographic characteristics of patients with stroke and to throw light on the most common presenting symptoms of patients with stroke.

Methods

Study Design

A cross sectional study was carried out to review all cases with stroke admitted to Children Welfare Teaching Hospital (CWTH)/4th ward during the period from May, 2008 to August, 2011. Ethical approval was obtained from the Research Ethical Committee - Human Resources Development and Training Center - Ministry of Health, Iraq.

Setting

Children Welfare Teaching Hospital is the tertiary pediatric referral center for Baghdad City. Annual admission is about 12,000 child/year. Revision of the ward registry and medical records was performed during the period from 1st of May to 1st of October, 2011.

Sampling Technique

Selection of Participants; Case identification for ischemic and hemorrhagic stroke was based on the 4th ward (neurology department) registry which commenced by seniors responsible for patients' diagnoses and management. All cases of stroke aged from 1 month to younger than 14 years who were admitted to the 4th ward

[neurology department] during the study period were recorded in that registry.

Cases were classified into ischemic and hemorrhagic stroke as follow⁽⁶⁾:

1. Ischemic stroke; Acute ischemic stroke was defined as acute neurologic deficits lasting more than 24 hours and caused by cerebral ischemia, with neuroimaging showing parenchymal infarction.
2. Hemorrhagic stroke; Hemorrhagic stroke was defined as an acute neurologic deficit lasting more than 24 hours, with neuroimaging showing intracranial hemorrhage.

The initial and most available neuroimaging used to confirm the diagnosis of both types was Computerized Tomography Scan (CT-brain, to be followed (if available) by Magnetic Resonance Imaging (MRI) sequences, and according to availability, Magnetic Resonance Angiography (MRA) was used in cases of arterial ischemic stroke or hemorrhagic type while Magnetic Resonance Venography (MRV) was used in cases of cerebral venous thrombosis. Patients included were those registered as to have stroke, ischemic stroke, hemorrhagic stroke, intracranial hemorrhage, intracerebral hemorrhage and those diagnosed with cerebral venous thrombosis. Ninety cases were found in the ward registry; only 69 were included, of which the medical records of only 25 cases were accessible at the time of the study because the hospital was under refurbishment, Twenty one cases were excluded according to the following criteria:

1. Patients with suspected (no definite) diagnosis of stroke.
2. Patients diagnosed later to have ADEM (Acute Disseminated Encephalomyelitis) or other stroke mimics.
3. Cases with traumatic intracranial hemorrhage.
4. Cases with hemiplagia but normal neuroimaging [as the patients' eligibility required a radiological diagnosis of ischemic stroke or lesion consistent with it].

Thus information contained in the ward registry was adopted, focusing on demographic information like age of first diagnosis, residence, types and sex. The presenting features of 25 patients were obtained from their medical records.

Statistical analysis

SPSS, version 16, was used for data input and analysis. Discrete variables presented as numbers and percentages and continuous variables presented as Median and mean ± SD (standard deviation). Chi square test for independence was used to test the significance of association between discrete variables. Mann-Whitney test for two independent samples was used to test the significance in observed difference in mean of continuous variables; this test was used as the age was shown to have extreme values with significant departure from normality according to Semivnov-Kolmogorov test for the assumption of normality. Findings with P value less than 0.05 were considered significant.

Results

Out of the ninety patients only 69 were included in the study, as the rest were excluded according to the exclusion criteria mentioned in the methodology. Among each 1000 patients admitted to the Children Welfare Teaching Hospital during the period of study, 1.8 patients presented with stroke, and the Annual hospital frequency rate of stroke /100,000 was 54.2 (Table 1).

Among the 69 patients; 49 were boys (71%) and 20 were girls (29%). Their ages ranged from 1-168 months with a mean of 25.8 months ± 37.2 SD and a median age of 10 months. Girls tend to be younger than boys yet the differences were statistically not significant (Table 2).

Table 1. Patients admitted to General Pediatric Wards during the study period

Variables	No.
Total admissions	37457
Total cases of stroke	69
Stroke / 1000 admissions	1.8
Annual hospital frequency rate of stroke /100000	54.2

Table 2. Distribution of the study group by age at first diagnosis (in months) and gender*

Age in months	Males (49)	Females (20)	Total (69)
Range	1-168	1-120	1-168
Mean±SD	28.3±40.5	19.8±27.4	25.8±37.2
Median	10	4	10

Patients with stroke were classified into; ischemic stroke (32 patients (46%), hemorrhagic Stroke (29 patients (42%)) and Cerebral Venous Thrombosis (CVT) (8 patients (12%) as shown in Figure 1. Cerebral venous thrombosis and arterial ischemic stroke can be included under the topic of ischemic stroke.

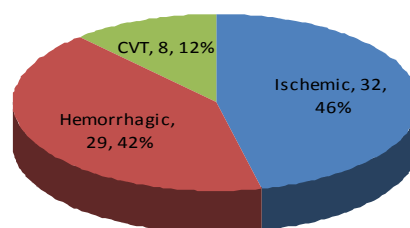


Figure 1. Distribution of the study group by type of stroke

Table 3 showed the distribution of the study group by type of stroke and gender. Although boys dominated girls in both ischemic stroke (72.5%) and hemorrhagic type (69%), yet the association was statistically not significant.

Table 3. Distribution of the study group by type of stroke and gender*

Type of stroke	Males		Females		Total	
	No.	%	No.	%	No.	%
Ischemic Stroke	29	72.5	11	27.5	40	100
Hemorrhagic Stroke	20	69	9	31	29	100
Total	49	71	20	29	69	100

* The association between sex and type of stroke was statistically not significant ($\chi^2=0.1$, $df=1$, $p>0.05$)

When age (in months) was considered, table 4 showed that patients with hemorrhagic stroke were significantly younger than those with ischemic type (Mann Whitney, $P < 0.05$), and on stratifying the two groups according to gender, girls with hemorrhagic type were significantly

younger than those with ischemic type (Mann Whitney, $P < 0.05$). The same results were reached for boys. Girls were younger than boys in both subtypes, yet the differences were statistically not significant (Mann Whitney, $P > 0.05$).

Table 4. Distribution of the study group by age (in months), gender and type of stroke

Gender	Type	P (Mann-Whitney)		
		Hemorrhagic	Ischemic	
Female	Range	1-96	2-60	0.012
	Median	2	18	
	Inter-quartile range	1-4	3-60	
	No.	9	11	
Male	Range	1-60	1-168	0.002
	Median	4	24	
	Inter-quartile range	2-10	6-60	
	No.	20	29	
Group Total	Range	1-96	1-168	<0.001
	Median	3	21	
	Inter-quartile range	2-9	6-60	
	No.	29	40	

On distributing the patients on three major age groups, (less than one year, 1-5 years and more than 5 years), table 5 showed that generally more than half of them were aged less than one year (55.1%), (34.8%) aged between 1-5 years and only (10.1%) were older than five years, the

majority of patients (82.8%) with hemorrhagic type were younger than one year and half (50%) of those with ischemic type were within 1-5 years of age and the association was statistically highly significant ($\chi^2=14.8$, $df=2$, $p<0.05$).

Table 5. Distribution of the study group by type of stroke and age groups*

Age groups (years)	Ischemic Stroke		Hemorrhagic Stroke		Total	
	No.	%	No.	%	No.	%
< 1 year	14	35	24	82.8	38	55.1
1 – 5 years	20	50	4	13.8	24	34.8
> 5 years	6	15	1	3.4	7	10.1
Total	40	100	29	100	69	100

* The association between types of stroke and age was statistically highly significant ($\chi^2=15.5$, $df=2$, $p<0.005$)

On reviewing patient's records; although the number of reviewed records was small, yet table 6 showed that the most common presentation among patients with both types was seizure (87.5%) in hemorrhagic type and (70.6%) in ischemic one), the second common presentation among patients with ischemic type was disturbed consciousness (47.1%),

hemiplegia and/or paresis (35.4%) and only (17.7%) of them presented with vomiting, whereas vomiting came in the second place among patients with hemorrhagic type (62.5%). 25% of those with hemorrhagic type presented with either bulging fontanel or pallor.

Table 6. Distribution of the study group by type of stroke and presenting complaint*

Presenting Complaint	Ischemic Stroke (17)		Hemorrhagic Stroke (8)		Total (25)	
	No.	%	No.	%	No.	%
Seizure *	12	70.6	7	87.5	19	76
Disturbed consciousness	8	47.1	1	12.5	9	36
Vomiting	3	17.7	5	62.5	8	32
Hemiplegia and /or paresis	6	35.3	0	0	6	24
Bulging fontanel	0	0	2	25	2	8
Pallor	1	5.9	2	25	3	12

*95%CI for differences between proportion of seizure as a presenting symptom in both types of stroke (-0.19 – 0.41); the difference was statistically not significant P> 0.05

Regarding seizure as presenting symptom, table 7 showed that most of those presented with seizure were below 1 year of age (79%).

Table 7. Distribution of patients with seizure as presenting symptom by age groups

Age groups	Seizure	
	No.	%
Less than one year	15	79
≥ 1year	4	21
Total	19	100

Table 8 showed the distribution of patients by residency. It was found that most of the patients (63.8%) were from Baghdad city, Kut was the second governorates in number of patients (11.6%) followed by Diyala governorate (7.3%).

Discussion

Up to our knowledge this is the 2nd study that described the experience of this hospital with

children who were admitted with features of stroke. The previous study⁽⁷⁾ included patients with stroke as those who were presenting with hemiplegia only without pointing to the inclusion and /or exclusion criteria or the neuroimaging as a definitive diagnostic criteria. The current study showed that the calculated annual hospital frequency rate of stroke was 54.2/100,000 children. This result is much higher than what was reported in two studies performed in Saudi Arabia^(8,9). The Children Welfare Teaching Hospital is a tertiary care center which drains a very wide area and this may partially explain this difference.

The mean age at first diagnosis was found to be 25.8 ± 37.2 months with a median of 10 months. A work done on Saudi children by Salih et al⁽⁹⁾ demonstrated similar age trend, whereas a study in Melbourne⁽⁶⁾ showed an older mean age than the current study, this could be attributed to including children up to 18 years of age in that study rather than 14 years, and it may be attributed to differences in the etiology and sociodemographic

characteristics between developing countries like Saudi Arabia and Iraq and developed countries like Australia. A non-significant trend of earlier age of presentation among females was shown in the current study. By reviewing the literature, no obvious explanation was found which prompted the need for further study to shed the light on this topic.

Table 8. Distribution of the study group by type of stroke and residency

Place of Residence	Stroke	
	No.	%
Baghdad	44	63.8
Kut	8	11.6
Diyala	5	7.3
Anbar	3	4.3
Missan	2	2.9
Other	7	10.1
Governorates		
Total	69	100

The current study showed that ischemic stroke is more common than hemorrhagic type which is consistent with other studies^(5, 9-11).

Stroke incidence as estimated from a state-wide hospital discharge database emphasize that boys carry higher risk for all stroke types than do girls⁽¹¹⁾. A Canadian study⁽¹³⁾ found a 3.6:1 male: female ratio for neonatal Cerebral SVT. Saudi Arabian⁽¹⁴⁾ study found a male: female ratio of 1.6:1 for neonatal arterial ischemic stroke. A population-based Californian study relying on administrative data found that boys had a higher incidence of childhood (non-neonatal) stroke than girls for both ischemic and hemorrhagic stroke types with a relative risk of 1.25 (95% CI, 1.11 to 1.40) for ischemic stroke⁽¹²⁾.

Normann et al provide provocative evidence that the male child's risk for arterial ischemic stroke or cerebral sinovenous thrombosis is linked to androgen availability⁽¹⁵⁾.

Specifically, elevated plasma levels (>90th percentile for age and gender) of the principal

circulating androgen, testosterone, were found to be associated with a 4-5-fold increased risk of cerebrovascular disease after adjustment for pubertal status, cholesterol, and hematocrit. Furthermore, among the boys, there was a dose-response relationship such that for each 1nmol/l increase in testosterone level, the odds of stroke were increased. This novel finding is the first to address androgens in pediatric stroke and is consistent with the rather sparse literature that androgens impact ischemic outcomes and mechanisms of brain damage⁽¹⁶⁾.

A significant trend that patients with hemorrhagic stroke tend to present at earlier ages than ischemic stroke and this was the same trend when stratified for sex, yet on reviewing the literature no explanation for this significant trend was found.

The risk of stroke in children is greatest in the first year of life and peaks during the perinatal period⁽¹⁷⁾. The current study showed that more than half of stroke events in children present at the infancy period (the hemorrhagic type is over-represented in the first year (82.3%) in comparison to the ischemic type (35%)). These results were confirmed in a previous study⁽¹⁸⁾ which showed large proportion (36%) of ischemic stroke events to occur in patients less than 12 months of age.

Symptoms like vomiting, bulging fontanel were common features in patients with hemorrhagic stroke and that's consistent with other studies^(6,19,20). Weakness was the main presenting feature in 6 (35.3%) patients with ischemic stroke and in none of those with hemorrhagic stroke and that's similar to what have been reported in other pediatric studies^(1,6), but this proportion was well below what other studies reported because this table view constellation of presenting symptoms that prompted the family to seek medical advice rather than the signs and symptoms that were recorded after examination by the physicians.

This study found that seizure was the most common presenting feature in the setting of acute childhood stroke (76%) with non-

significant trend to be more common in hemorrhagic than in Ischemic types. The study done by Zimmer et al⁽²¹⁾ demonstrated the age trend with seizures being more frequent in younger children when looking at childhood arterial ischemic stroke. Wide ranges exist in the literature regarding the incidence of early seizures in children following stroke, ranging from 34 to 53.8%⁽²²⁾.

Youngest children tend to have higher rates of early seizure in the stroke setting. The occurrence of higher seizure rates in children than in adults is likely due to immaturity of the neural networks leading to imbalances in excitatory and inhibitory amino acids. This, in turn, can cause increased excitation or decreased inhibition which, can lead to increased susceptibility to develop seizures^(22,23). Other studies found that this presentation can be more common than hemiparesis especially in the neonatal period^(24,25).

Nearly two thirds (63.8%) of the patients in the current study were from Baghdad city, where the hospital is, and as a tertiary center many cases are referred to this center from nearby governorates.

We conclude that pediatric stroke is not uncommon in Iraqi children; arterial ischemic stroke is over-represented in children less than 12 months of age, furthermore hemorrhagic strokes present in children younger than ischemic stroke. Rapid assessment and diagnosis can be achieved by increasing awareness of pediatricians that vomiting, headache, and altered conscious states are indicators of serious intracranial pathology, warranting urgent neuroimaging. Childhood ischemic stroke appears to be more common in boys regardless of age and stroke subtype. Further exploration of this gender difference could shed light on stroke mechanisms in both children and adults. Complete stroke registries are necessary to provide information for future studies. Further studies evaluating a larger population in different clinical settings are

required to provide a more comprehensive picture of stroke in children in this area.

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