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Predictors of arterial ischemic stroke outcome in children

Summary

There are limited knowledge and controversies on prognostic factors for outcome. It has been shown that the long-standing believe that younger children have better prognosis has to be revised.[1] Neuroimaging might play a major role for prognosis, but knowledge is still limited.[1]

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Tatia Aprasidze

Neuroscience Department, David Tvildiani Medical University, Georgia

Correspondence: Tatia Aprasidze, Neuroscience Department at M. Iashvili Children's Central Hospital, Tbilisi, Georgia, Email tatia_afrasidze@yahoo.com

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Introduction, Aim

Research on peadiatric stroke has become increasingly more important over the last decade. Recent studies suggest an incidence of childhood stroke of 2-5/100.000 children per year.[2] Despite its low incidence, stroke ranks among the top 10 causes of death in children.[3] In more than half of the surviving children who had a stroke, the risk of motor, behavioral and cognitive disorders and epilepsy results in major long-term personal, family and social consequences.[4,5] The condition carries a risk of recurrence in approximately 10-20% of cases.[1,6] Mortality rate of pediatric arterial ischemic stroke (AIS) ranges from 10-20%[7] and may be higher in recurrent stroke. No estimates of pediatric stroke burden are available for Georgia. The aim of the study is to evaluate outcome of children with arterial ischemic stroke (AIS) and explore predictive factors that affect outcome.

Methods

Population

Children aged of 1month to 17years with the diagnosis of arterial ischemic stroke, proved by magnetic resonance imaging (MRI), who were treated at M. Iashvili Children's Central Hospital, with the onset of stroke from 2009 were included.

An exclusion criterion was transient ischemic attack (TIA), patients who had ischaemic stroke within the first month of life, and incomplete records.

Data collection

Data were collected from hospital records and included demographic characteristics, clinical data, and neurological impairments at onset, affected arteries, vascular distribution areas involved, possible causes and risk factors for stroke, presence of stroke recurrence and status at discharge.

Outcome was evaluated using Pediatric Stroke Outcome Measure (PSOM), which is based upon a clinical neurological examination.[8] Neurologic deficit severity based on the scores: A deficit score ranging from 0 to 2 (0=no deficit; 0.5=mild deficit but no impact on function; 1=moderate deficit with some functional limitations; 2=severe deficit with missing function) was assigned for each of the following 5 'spheres': (a) right sensorimotor and (b) left sensorimotor (both including visual, hearing, motor and somatosensory function); (c) language production; (d) language comprehension; (e) cognitive and behavioral performance. The sum of the scores of the five subscales is a total score ranging from 0 to 10.[8] The authors of the scale of PSOM have classified outcome as 'favourable' if the child had no impairments (score 0.5 in only one of five domains) and in other instances, outcome was categorized as 'unfavourable' (i.e. two or more 0.5 scores, or at least one score of 1 or 2.[8]

Results

50 patients (25male/25female) were investigated. The most –31 of childhood stroke cases were obtained in patients aged 1month to 4years, followed by 11 patients in the age group of 4 to 9years and 8 aged 10 to 17years.

Symptoms at presentation

The main clinical signs were hemiparesis in 38(76%) patients, left-sided in 22 and right-sided in 16. Seizures were presenting symptom in 23(46 %) cases, facial palsy in 17(34%), aphasia in 13(26%), headache in 12 (24%), cognitive and behavioral deficit in 12(24%), low level of consciousness (LOC) – in 10(20%), vomiting in 6(12%), fever in 6(12%), ataxia in 2(4%) and visual field deficit in 2(4%) patients.

Radiological features

Of the 50 children 40 had isolated infarction and 10 had multiple infarction; In 39/50 cases territory of middle cerebral artery was affected, in 1 – anterior cerebral artery (ACA), and 10 had involvement of posterior cerebral artery (PCA); 26/50 patients suffered from stroke in the left hemisphere, 15/50 had a right-sided stroke and 9/50 patients had bilateral stroke; Combined cortical and subcortical infarction was detected in 10 patients; Large arteries were affected in 30, small arteries in 20 cases; Hemorrhagic component was found in 8 patients (Table 1).

Risk factors

Risk-factors were identified in 17/50 (34%) patients: In the group of vasculopathies 3 patients were diagnosed with moya-moya disease, 1 had arterial dissection; Cardiopathy occurred in 4 patients; In the group of systematic disease 1 child had renal disorder and arterial hypertension, 1 - MELAS, 1 patient was with Sturge-Weber syndrome;

3 patients were diagnosed with encephalitis, 3 had Varicella infection 3-12 months prior the stroke; 1 patient was suspected to have vasculitis.

Table 1 Radiological features

Radiological features	N(%)
Multiple stroke	10/50(20%)
Bilateral stroke	9/50(18%)
Unilateral stroke: Left hemisphere/right hemisphere	63%/37%
Anterior circulation/Posterior circulation/Both	80%/12%/8%
Basal ganglia MCA/Cortical MCA/Subcortical MCA	42%/44%/70%
Massive MCA stroke	7/50(14%)
Anterior Cerebral Artery(ACA)	1/50(2%)
Posterior Cerebral Artery(PCA)	10/50(20%)
Artery size: Large	30(60%)
Small	20(40%)
Hemorrhagic component	8(16%)
Recurrence	5(20%)

Status at discharge: From 50 patients 8 had no deficit at discharge.

Outcome: Long-term outcome was assessed ≥1 year after stroke (1 to 7years). The results of the PSOM subscales are shown in Figure 1. Deficit was more frequent on the right side than on the left side, and it was moderate or severe. Language deficit occurred in 8(32%), and cognitive and behavioral deficit in 12(48%) patients. The results of total PSOM score are shown in Figure 2. The outcome based on PSOM assessment: no deficit, 20(40%); mild deficit, 5(10%); moderate deficit, 19(38%); and severe deficit, 6(12%). Stroke recurrence occurred in 5(10%) patients. According to PSOM scores neurological outcome was favorable in 50 % of patients (20 without and 5 with mild neurological deficits), and unfavorable in 50% with moderate to severe deficits. Epilepsy at evaluation was reported in 6 patients.

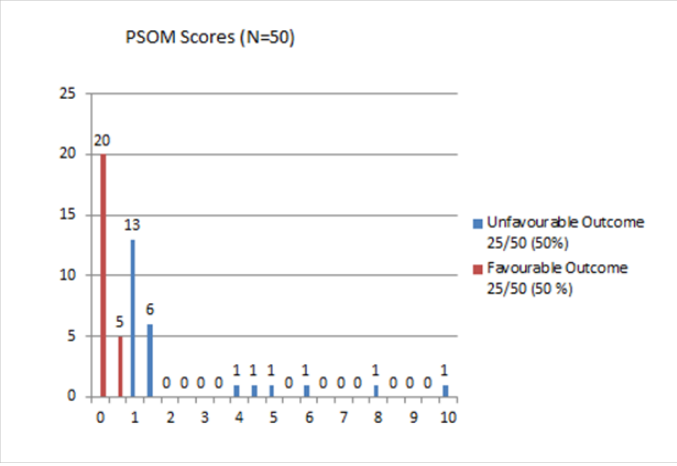

Figure 1 Score of the subscales (0 no deficit, 0.5 mild deficit, 1 moderate deficit, 2 severe deficit).

Predictive factors for outcome were assessed according to PSOM results. Prognosis was unfavorable in 50% of children, with moderate to severe deficits. The factors that had an influence on outcome are shown in Table 2.

Table 2 PSOM results

AIS(n=50)	Favorable outcome N=25(50%)	Unfavorable outcome N=25(50%)
Age at stroke: 1mo to 4years	12(48%)	19(76%)
5 to 9years	8(32%)	3(12%)
10 to 17years	5(20%)	3(12%)
Recurrent stroke n=5(10%)	2(8%)	3(12%)
Hemiparesis at presentation n=38	4(16%)	23(92%)
Epilepsy at evaluation	4(16%)	2(8%)
Basal ganglia N=21	13(52%)	8(32%)
Cortical and subcortical involvement	2(8%)	8(32%)
Massive MCA stroke	2(8%)	5(20 %)
Large artery n=30	11(44%)	19(76%)
Small artery n=20	14(56%)	6(24%)

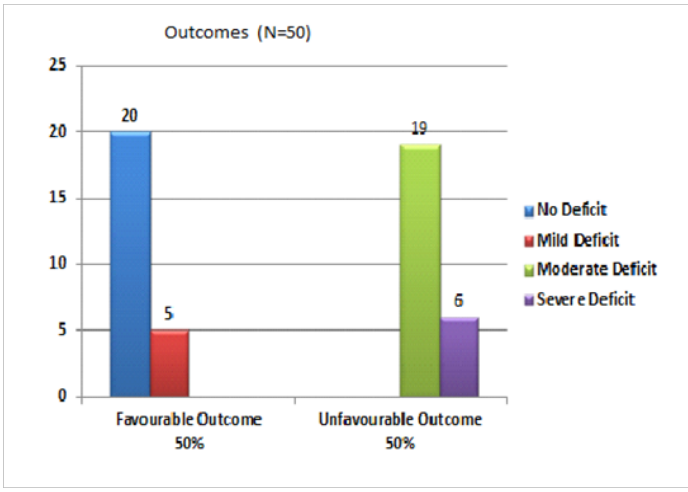

Figure 2 Results of total PSOM score.

Discussion

According to our study outcome was worse in patients with younger ages at stroke. Even if it is widely believed that brain plasticity can lead to improved outcome following acquired brain injury at an early age, there is increasing evidence to support the hypothesis that younger age at time of stroke is a predictor of a worse outcome, particularly for cognitive and neuropsychological domains.[8,10] Our results are similar to other authors, regarding stroke size and cortical and subcortical involvement association with poor outcome. No significant relationship was found between prognosis of

stroke and gender, risk-factors, stroke recurrence, bilateral, multiple stroke and hemorrhagic component. Epilepsy wasn't associated with poor outcome.

Conclusion

Stroke is a cause of significant morbidity with moderate to severe deficits in half of the patients. Younger age, lesion size was associated with poor outcome. Our study is still ongoing study. It is planned to investigate more patients in terms of long-term cognitive outcome.

Acknowledgments

None.

Conflicts of interest

Author Declare their are no conflicts of interest.

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