Journal of the Neurological Sciences 325 (2013) 67–73

Contents lists available at SciVerse ScienceDirect

Journal of the Neurological Sciences

journal homepage: www.elsevier.com/locate/jns

Experience of pediatric stroke from a tertiary medical center in North India

Jayantee Kalita, Gourav Goyal, Usha Kant Misra *

Department of Neurology, Sanjay Gandhi Post Graduate Medical Sciences, Lucknow, India

ARTICLE INFO

Article history:
Received 7 September 2012
Received in revised form 27 November 2012
Accepted 29 November 2012
Available online 23 December 2012

Keywords:
Ischemic stroke
Intracerebral hemorrhage
CVST
Mortality
TBM
Cardioembolic
Children
Stroke
Pediatric

ABSTRACT

Objective: The etiology and outcome of pediatric stroke differs in different geographical regions and there is no comprehensive study from India. This study evaluates the etiology, type and predictors of outcome of pediatric stroke from Northern India.
Methods: 79 stroke patients aged 1 month to 18 years managed during 2001–2011 were retrospectively analyzed. Their mean age was 144.8 months (0.6–18 years) and 26 were females. Detailed history including stroke risk factors was noted. The clinical, imaging and laboratory findings were recorded. Stroke was classified as per neuroimaging findings. The predictors of death were evaluated by multivariate analysis.
Results: 62 (78.5%) patients had arterial ischemic stroke (AIS), 10 (12.7%) intracerebral hemorrhage (ICH) and 7 (8.9%) had cerebral venous sinus thrombosis (CVST). The underlying etiology was neuroinfections in 25, cardioembolic in 9, prothrombotic conditions in 5, arteriopathy in 4, arterial dissection in 3, mitochondrial cytopathy and cervical rib in 1 each and cryptogenic in 13 patients. 7 patients died. On multivariate analysis death was related to level of consciousness on admission.
Conclusion: AIS is more common than ICH in this study and 8.9% patients died. Infection is the most common cause of pediatric stroke in Northern India which is amenable to therapy and is preventable.

1. Introduction

Childhood stroke is defined as the stroke occurring between the age of 1 month to 18 years [1]. The annual incidence of pediatric stroke is reported to range between 1.1 and 3.13/100,000 from the developed countries. Hemorrhagic stroke in pediatric population is more common than adults (45% vs 10%) [2]. In the Asian countries, there is paucity of epidemiological data on pediatric stroke. Hospital based studies from Japan, Argentina, Hong Kong, Turkey, India, Thailand, China, Pakistan and Kenya have reported variable incidence of stroke and differing etiologies [3–11]. Very few studies have reported the prognostic predictors of pediatric stroke. The etiology of pediatric stroke depends on several factors such as prevalence of infection, malnutrition, genetic predisposition and health infrastructure. From India, there is only one study on pediatric stroke [12]. In the present communication, we report the etiology, predictors of mortality and short term outcome of pediatric stroke from a tertiary care center in Northern India.

2. Materials and methods

The stroke patients aged 1 month to 18 years admitted to Sanjay Gandhi post graduate medical sciences during 2001 to 2011 were retrospectively analyzed. This is a tertiary care super specialty teaching institute consisting of neurology, nephrology, cardiology, endocrinology, gastroenterology, hematology, immunology, genetics, radiotherapy, nuclear medicine, neuroradiology and its allied surgical specialties as well as supportive investigative departments. The neurology department has 5 dedicated pediatric neurology beds. In the state of Uttar Pradesh, India, pediatric neurology is yet to develop as a separate specialty, therefore, neurologists and pediatricians both take care of pediatric patients with neurological diseases. We have excluded neonatal stroke due to lack of obstetric department in our institute; moreover, neonatal stroke has different etiology, presentation and outcome. Discharge summaries and the laboratory data were obtained from the computerized hospital information system. The patients' demographic data (age, gender, area of residence and religion) were recorded. The history of fever, headache, vomiting, seizure, head injury, joint pain, skin rash, dyspnea, palpitation, anemia, bleeding diathesis and family history of similar disease were noted. The type of stroke was categorized into ischemic (arterial or venous) and intracerebral hemorrhage (ICH).

a) The arterial ischemic stroke (AIS) was defined on the basis of acute focal neurological deficit with corresponding CT or MRI evidence of infarction in an arterial territory.
b) The diagnosis of cerebral venous sinus thrombosis (CVST) was based on MR venography findings with evidence of thrombosis in the cerebral venous sinuses or veins.
c) Intracerebral hemorrhage was diagnosed on the basis CT or MRI with corresponding clinical findings.

* Corresponding author at: Department of Neurology, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Raebareily Road, Lucknow-226014, India. Tel.: +91 522 2494167; fax: +91 522 2668017.
E-mail addresses: drukmisra@rediffmail.com, ukmisra@sgpgi.ac.in (U.K. Misra).

0022-510X/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.jns.2012.11.020

The AIS was classified according to TOAST (Trial of Org 10172 in Acute Stroke Treatment) criteria [13]. The cranial imaging was done using either a third generation CT scanner or a 1.5 T MRI scanner, Signa GE, Medical system, Wisconsin, USA. The location and arterial territory of infarction were noted. In the patients with CVST, the location and extent of thrombosis, and presence of parenchymal lesion (ischemic or hemorrhagic) were also noted. In the patients with ICH, the location of hematoma was recorded.

2.1. Evaluation

The presence of edema, jaundice, cyanosis, lymphadenopathy, petechial hemorrhage, purpura, bruit, cardiac findings and hepatosplenomegaly were noted. Admission vital parameters (heart rate, blood pressure, respiratory rate), consciousness as assessed by Glasgow Coma Scale (GCS) and focal neurological deficit (monoplegia, hemiplegia, quadriplegia, aphasia, visual field defect, cranial nerve palsy and sensory abnormalities) were noted. Focal weakness was graded into hemiparesis or hemiplegia.

2.2. Risk factor assessment for AIS

Risk factors for arterial ischemic stroke were divided into 3 groups: nonmodifiable, well documented and modifiable, and less well documented but potentially modifiable risk factors [14]. Nonmodifiable risk factors include age, gender and ethnicity. Well documented and modifiable risk factors include dyslipidemia, smoking, hypertension, diabetes mellitus, obesity, underlying cardiac diseases, atrial fibrillation, CNS infections and prior stroke or transient ischemic attack. Dyslipidemia includes hypertriglyceridemia, hypercholesterolemia, low high density lipoprotein (HDL) and high low density lipoprotein (LDL). For pediatric age group, the upper limit of normal serum triglyceride was 150 mg/dl, cholesterol 200 mg/dl and LDL 130 mg/dl and lower limit of HDL was 35 mg/dl [15]. Less well documented but potentially modifiable risk factors include history of migraine, recent heavy drinking, patent foramen ovale/atrial septal defect, oral contraceptive use, obstructive sleep apnea, pregnancy/postpartum period, illicit drug use, active malignancy and prothrombotic conditions as antiphopholipid antibodies, factor V Leiden mutation.

2.3. Investigation

Hemoglobin, blood counts, ESR, blood smear, blood sugar, serum creatinine, lipid profile, ECG, radiograph of chest and echocardiographic findings were noted. Patients without cardiac or other apparent cause were evaluated for prothrombotic conditions such as protein C, protein S, antithrombin III, anticardiolipin antibody, antinuclear antibody, factor V Leiden mutations, test for sickling and hemoglobin electrophoresis. CSF was analyzed in the patients with suspected CNS infection. CT or MR angiography and MR venography were recorded if available.

The risk factor evaluation however was guided by the clinical clues. Before labeling the patients as cryptogenic an extensive risk evaluation was done. The protocol of evaluation of risk factors and underlying etiology of pediatric stroke is shown in Fig. 1.

2.4. Treatment

The patients with noncardioembolic AIS were treated with antiplatelet therapy (25–150 mg/day) and the patients with CVST received heparin infusion for 15 days followed by oral anticoagulant. The patients with ICH were managed medically in the acute stage. The patients with acquired or congenital heart disease with or without atrial fibrillation received anticoagulant. Associated infection was treated by appropriate antibiotics, antitubercular or antifungal treatment and vasculitis with corticosteroids. Seizures were managed by antiepileptic drug.

2.5. Outcome assessment

The outcome of pediatric stroke was assessed at the time of discharge from hospital by using King's Outcome Scale for Childhood Head Injury (KOSCHI) scale [16]. KOSCHI scale is a pediatric modification of the Glasgow Outcome Scale characterizing global functional status. This scale includes 5 categories:

Category 1: Death
Category 2: Vegetative state
Category 3: Severe disability
Category 4: Moderate disability
Category 5: Good recovery

2.6. Statistical analysis

The hospital mortality and the functional status at the time of discharge from the hospital were correlated with demographic (age, gender) and clinical (GCS score, severity of weakness, seizures) and radiological (type and location of stroke) data using Fisher exact or Chi square test for categorical variables and independent t test or Mann Whitney U test for continuous variables. Multivariate regression analysis was done to derive the best set of predictors of death and functional outcome using the variables having P value of less the 0.1. All the analyses were done using SPSS 16 version software. The variables were considered significant if two tailed P value was <0.05.

3. Results

There were 82 stroke patients between the age of 1 month and 18 years during the study period; 3 of whom were excluded because of incomplete information; the results therefore are based on 79 patients whose mean age was 144.8 ± 67.8 months (range 0.6–18 years) and 26 (32.9%) were females. The highest frequency of stroke was noted in the second decade (64.6%) followed by 5–10 years of age group (19%). The etiology of stroke subtypes is presented in Table 1.

The presenting symptoms were motor deficit in 46, visual deficit in 1, ataxia in 2, altered sensorium in 12, headache in 1 and seizures in 17 patients. Thirty six (45.6%) patients had seizures during the acute illness. Sixty two (78.5%) patients had ischemic stroke, 10 (12.7%) ICH and 7 (8.9%) had CVST. The presenting symptoms of ischemic stroke, ICH and CVST were not significantly different.

3.1. Arterial ischemic stroke

Among nonmodifiable risk factors, males (62.9%) were more frequently affected compared to females ($P = 0.04$) their age difference was not significant ($P = 0.97$). Hypertriglyceridemia was significantly more in females ($P = 0.01$). Both the hypertensive patients were males. The distribution of risk factors has been shown in Table 2. Out of 62 patients with ischemic stroke, cardioembolic stoke was present in 9 (14.5%), other determined etiology in 34 (54.8%), multiple etiologies in 6 (9.7%), undetermined etiology with extensive evaluation in 4 (6.5%) and undetermined etiology with limited evaluation in 9 patients (14.5%). None of the patient had large artery atherosclerosis. In the majority of patients, the underlying etiology was infective in 25 patients which included central nervous system infection in 24 {tuberculous meningitis in 21 (Fig. 2), fungal in 2, neurocysticercosis in 1} and 1 patient had hepatitis C virus associated vasculitis. The next common group of ischemic stroke was cardioembolic stroke (9 patients; Fig. 3 A and B). Other etiologies of ischemic stroke were prothrombotic conditions in 5, arteriopathy in 4, arterial dissection in 3, mitochondrial cytopathy in 1, cervical rib in 1, atlantoaxial dislocation in 1 and no underlying etiology could be found in 13 patients. The etiologies of ischemic stroke are summarized in Table 1.