International Journal of Basic and Applied Medical Sciences ISSN: 2277-2103 (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jms.htm
2014 Vol. 4 (2) May-August, pp. 246-257/Shivalli et al.
Research Article

CLINICAL ANALYSIS OF PEDIATRIC HEMIPLEGIA AT TERTIARY CARE HOSPITAL IN BANGALORE

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ABSTRACT
The term Stroke or Cerebrovascular Accident is defined as a focal neurological deficit lasting more than 24 hours with a vascular basis. The cause of stroke in children is established in approximately 75% of cases. [2] Children of all ages can have hemiplegic stroke just as adults do but there is often more uncertainty about the mechanism of the stroke in childhood than there is in adult life. The a***ims and objectives were t***o study the clinical profile of stroke in children as presented in a hospital set up and to determine the possible etiology of the condition. This is a descriptive study done to evaluate the clinical profile of patients with hemiplegia in pediatric age group, at the Department of Pediatrics at Vydehi Institute of Medical Sciences and Research Center, Bangalore from August 1st 2005 to July 31st 2006.
Onset of stroke was more common within 2 years of age (75% of cases). Right-sided weakness was more common than left sided. Acute onset of hemiplegia was more common (60%). Fever was the commonest preceding symptom (50%) followed by convulsions (30%) and variable levels of altered sensorium (25%). Behavioural problems were seen in 25% of cases. Speech was affected in 40% cases. Asymmetry of affected limb was seen in 70% of cases. Stroke in childhood is less studied in Indian seniro, the study has made an attempt to evaluate the causes of stroke in child hood. Further evaluations with modern gadgets are needed to investigate the unknown group.

Keywords: *Stroke, Child Hood, Hemiplegia, Bangalore*

INTRODUCTION
The term Stroke or Cerebrovascular Accident is defined as a focal neurological deficit lasting more than 24 hours with a vascular basis (Kirkham, 1999). The term cerebrovascular accidents has been known prior to Hippocratic era, and the terms like "Apoplexy", "Stroke", "Paralysis", have been in common use, long before coronary artery disease was even recognized., Sigmond Freud provided one of the earliest descriptions of stroke in childhood in late 18th century. By 1930 there were detailed case reports and autopsy series with pathological descriptions of cerebral lesions in childhood strokes. The cause of stroke in children is established in approximately 75% of cases (Haslem, 2004). Children of all ages can have hemiplegic stroke just as adults do but there is often more uncertainty about the mechanism of the stroke in childhood than there is in adult life (Bax and Mitchell, 1961).

Objectives
1. To study the clinical profile of stroke in children as presented in a hospital set up.
2. To determine the possible etiology of the condition.

MATERIALS AND METHODS
This is a descriptive study done to evaluate the clinical profile of patients with hemiplegia in pediatric age group, at the Department of Pediatrics at Vydehi Institute of Medical Sciences and Research Center, Bangalore from August 1st 2005 to July 31st 2006.

Inclusion Criteria
1. Children between 2 months to 15 yrs of age at the time of presentation to hospital.
2. Children presenting with hemiplegia/hemiparesis.

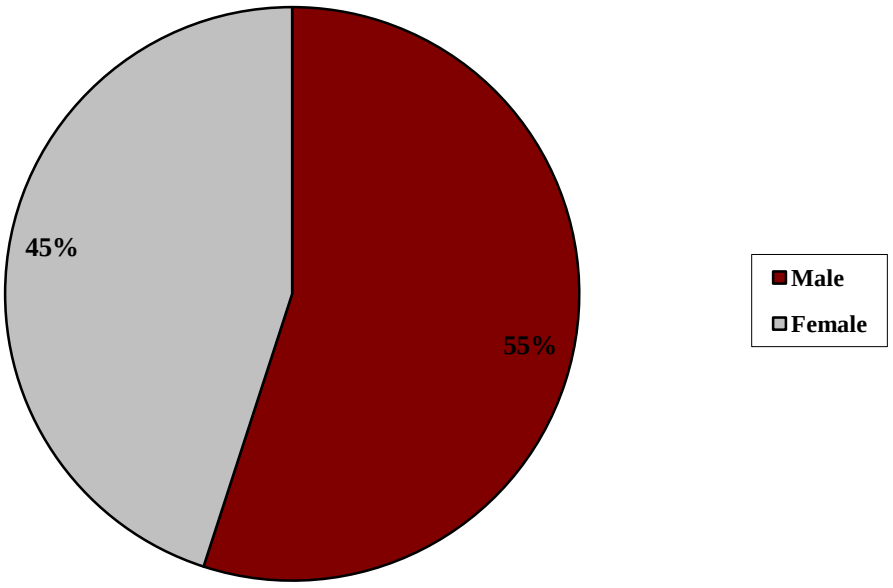
Exclusion Criteria
1. Children suspected of having progressive degenerative disorder.
2. Children with gross congenital anomalies.

3. Children with well recognized neurological syndrome.
4. Children with gross mental retardation.

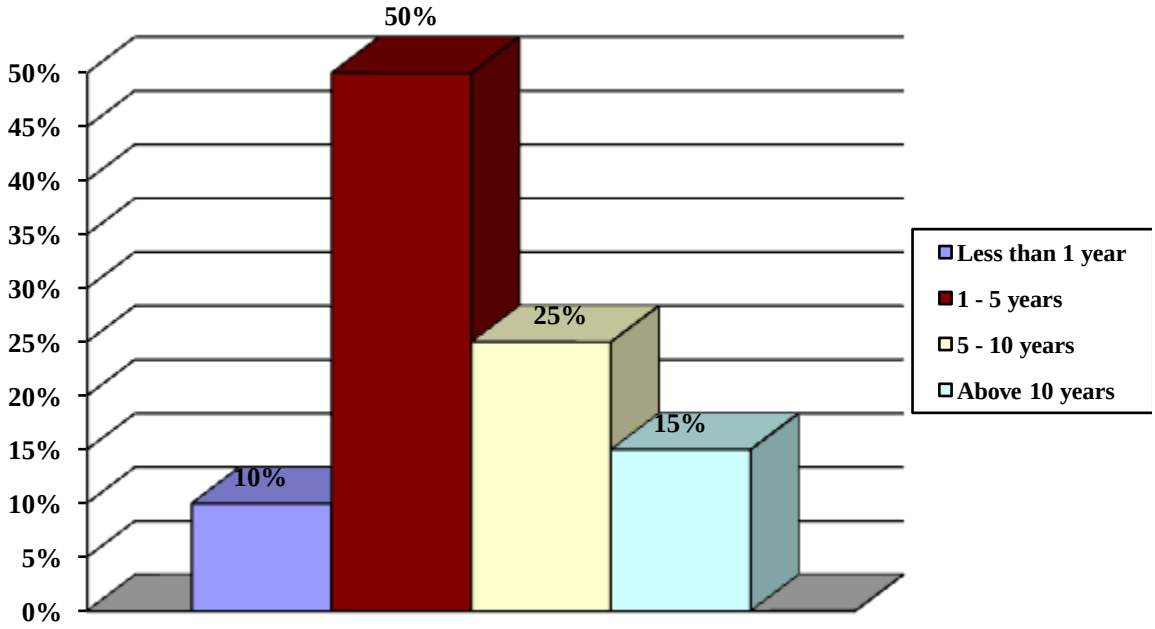
Informed consent was taken in each case. The clinical history was meticulously elicited from the parents. Available previous medical documents were studied. Detailed history and clinical examination were done and findings recorded in a preset Proforma. Relevant available investigations were done to ascertain possible etiology.

RESULTS AND DISCUSSION

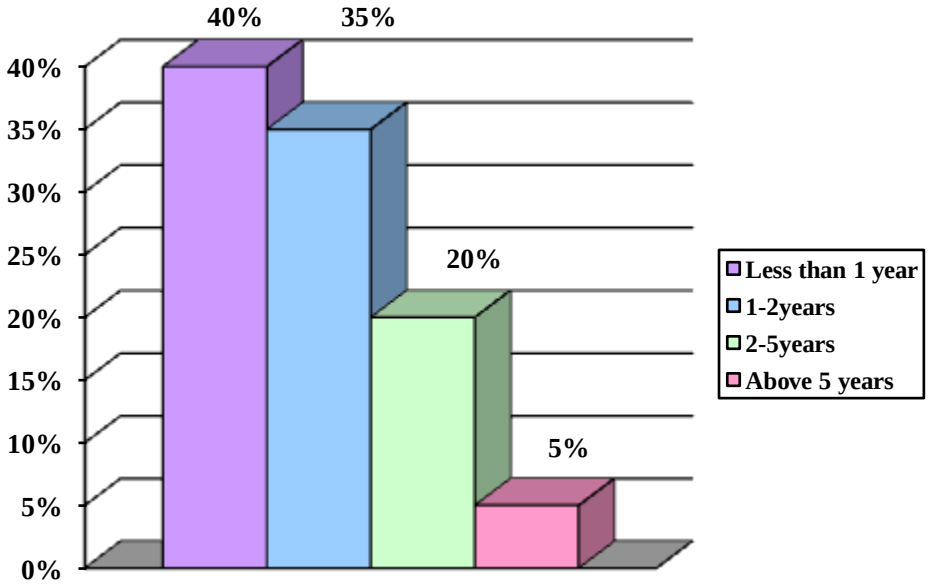
Results



Graph 1: Sex Distribution



Graph 2: Age Distribution



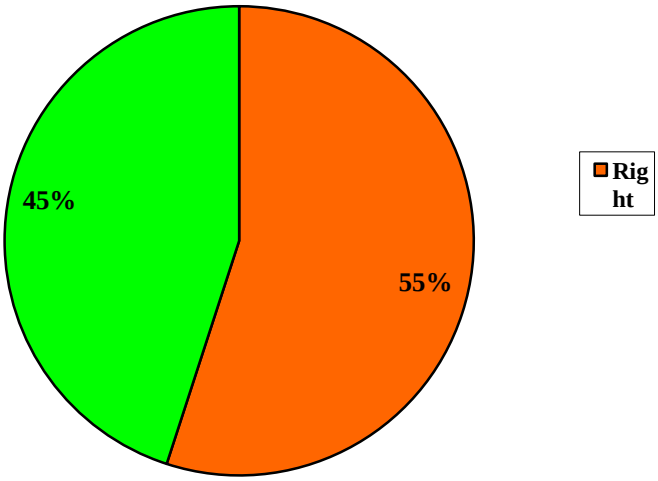
Graph 3*:* Age of Onset

Table 1: Mode of Onset

	No. of cases	**Percentage (%)**
Abrupt	07	35
Acute	12	60
Stuttering	01	05

Table 2: Prodromal Symptoms

	No. of cases	**Percentage (%)**
Fever	10	50
Convulsion	6	30
Altered sensorium	5	25



Graph 4: Involved Side of Weakness

Table 3: Behavioural Problems

	No. of cases	Percentage (%)
Normal	15	75
Hyperactive	4	20
Lethargic	1	5

Table 4: Associated Neurological Signs

	No. of cases	Percentage (%)
Speech abnormality	08	40
Asymmetry of Limb	14	70
Facial nerve palsy	05	25
Meningeal irritation	02	10
Abnormal movements	1	05

Table 5: Tone of the Affected Side

	No. of cases	Percentage (%)
Increased	16	80
Normal	4	20

Table 6: Power of the Affected Side

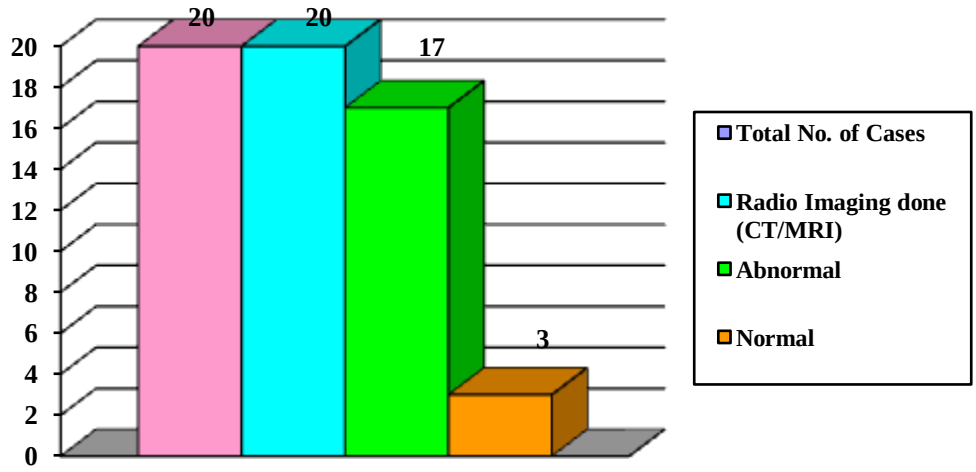
Grade of power	No. of cases	Percentage (%)
2	1	5
3	14	70
4	05	25

Table 7: Deep Tendon Reflex of the Affected Side

	No. of cases	Percentage (%)
Brisk	12	60
Normal	7	35
Sluggish	1	05

Table 8: Abnormal Investigation Results

Investigation	*No. of patients with abnormal results*
CSF analysis	03
CT scan	16
MRI scan	01
EEG	02
Mantoux test	02



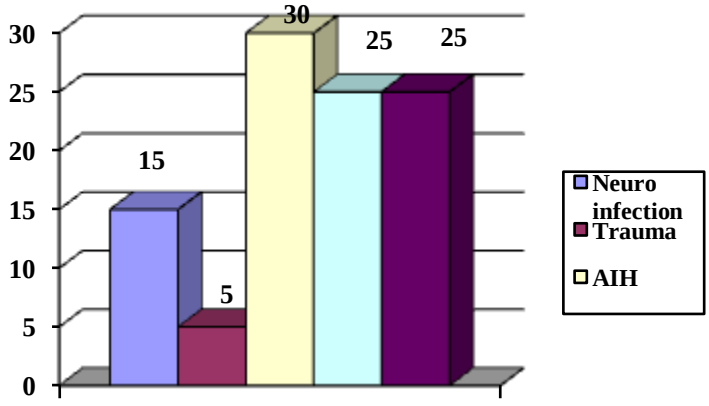
Graph 5: CT/MRI

Table 9: Type of Lesions seen in Cranial CT/MRI

Type of Lesion	No. of Cases	Percentage (%)
MCA territory infarction	16	80
ACA territory infarction	01	05
Basal ganglia infarction	03	15
Porencephalic Cyst	05	25
Gliotic changes	03	15
Cerebral atrophy	02	10

Table 10: Etiological Pattern recorded in our study

	No. of cases	Percentage (%)
Neuroinfection	03	15
Trauma	01	05
Acute infantile hemiplegia	06	30
Perinatal insult	05	25
Unknown etiology	05	25



Graph 6: Etiological Pattern recorded in our study

Discussion

Stroke is considered rare in children, studies conducted during seventies have supported this view. But later studies revealed that stroke in children are not an uncommon event (Schoenberg *et al.*, 1978; Giroud *et al.*, 1995). The incidence of stroke has been increasing over years. A predisposing condition like heart disease, prothrombotic conditions has been identified in majority of cases. The better survival of these previously fatal conditions has contributed to this increase in incidence (De Veber, 2002).

Many earlier studies have been done to know the clinical features, etiology, survival, etc., of stroke in children (Giroud *et al.*, 1997; Nagaraja *et al.*, 1994; Obama *et al.*, 1994; Schoenberg *et al.*, 1978; Schoenberg *et al.*, 1978; Awada *et al.*, 1994). All these studies have excluded CNS infections and congenital malformations. This has underestimated the magnitude of the problem. Stroke due to any cause is a disabling condition for the affected child.

We studied 20 cases who presented with hemiplegia/hemiparesis during our study of 1 year.

In our study boys were more affected than girls. Many reports show increased incidence in boys (Giroud *et al.*, 1997; Nagaraja *et al.*, 1994; Obama *et al.*, 1994; Schoenberg *et al.*, 1978; Schoenberg *et al.*, 1978; Awada *et al.*, 1994).

Preschool children have been affected more often in our study. This has been the case with most of the available literature (Giroud *et al.*, 1997; Nagaraja *et al.*, 1994; Obama *et al.*, 1994; Schoenberg *et al.*, 1978; Schoenberg *et al.*, 1978; Awada *et al.*, 1994).

The mode of onset was abrupt in 35%, 60% of cases had acute onset of hemiplegia without any seizure activity and one case had stuttering pattern.

Clinical profile has been the focus of attention in our study and if possible to determine the etiology. Hemiplegia was more often on right side than on left side. This view is supported uniformly by all other studies (Giroud *et al.*, 1997; Nagaraja *et al.*, 1994; Obama *et al.*, 1994; Schoenberg *et al.*, 1978; Schoenberg *et al.*, 1978; Awada *et al.*, 1994).

Fever was the commonest preceding symptom (50%). Grau *et al.*, (1995) case control study highlighted the role of fever as predisposing factor for stroke. Fever may be predisposing factor as well as symptom of etiology for stroke (Takeoka and Takahashi, 2002).

As in any other neurological illness seizure was an important presenting symptom of stroke. Yang *et al.*, (Nagaraja *et al.*, 1994) studied the incidence of seizures in children and young adults with acute hemiplegia in stroke. 49% had convulsion and 29% had recurrent seizure in his study. Convulsion occurred in 30% of our cases. Giroud *et al.*, (1997) observed seizures in 32%. Dusser *et al.*, in 31%.

Other neurological symptoms seen in our study was speech defects in 40% cases wherein 15% had aphasia. Obama *et al.*, (1994), Giroud *et al.*, (1997) recorded 28.6%.

Behavioural problems were seen in 25% of cases wherein 20% were hyperactive. The development of this hyperkinetic behavioural pattern following the acute insult to CNS is common in children with hemiplegia syndrome (Gold and Carter, 1976).

35% cases had immediate provocation with infection in our study. Eeg and Ringheim (1983) observed 6 cases of 26 (23%) with infection occurring a few days upto 2 weeks

Earlier (Eeg and Ringheim, 1983). A possible dehydration during fever, a possible vasculitis, or a thrombotic process may constitute trigger factors, as Raybaud *et al.*, (1985) have indicated.

Asymmetry of affected limb was seen in 70% of cases wherein growth of thumb was more affected in our study. Hemiatrophy (dwarfing of involved limbs) is related to parietal lobe involvement and is more likely to develop with paralysis of early onset (Bax and Mitchell, 1961; Gold and Carter, 1976).

The cranial nerve palsies help in anatomical localization of lesion. The cranial nerves may be affected directly as in entrapment or secondarily due to vasculitis. Cranial nerve palsy may be a false localizing sign in conditions with raised intracranial tension. 25% of our cases had cranial nerve palsies. Obama *et al.*, (1994) recorded 62.9%. An abnormal movement was noted in one case (5%) in our study.

The risk factors for stroke in children are multiple. The etiology is also varied compared to adults. A thorough diagnostic evaluation is warranted in all children as multiple risk factors co-exist in one patient.

Appropriate identification and management of these risk factors helps in reducing the risk of recurrence, which in turn reduces the mortality (Lanthier *et al.*, 2000).

The investigation panel has to be carefully chosen depending on the clinical scenario. The limited financial and laboratory resources are major handicaps in our country while investigating these cases.

Routine lab investigations are usually not contributory in establishing diagnosis (Nagaraja *et al.*, 1994; Obama *et al.*, 1994). Our experience is no different.

Hartfield *et al.*, (1997) identified iron deficiency anemia as an etiological agent for stroke in 6 children aged 6-18 months. An AIIMS study identified iron deficiency anemia with secondary thrombocytosis as second most common cause for stroke in children (Takeoka and Takahashi, 2002). Anemia was common among our study cases (55%). This has been the case with NIMHANS study also. This high prevalence of anemia may be a reflection of increased frequency of anemia among Indian children. However, we could not establish iron deficiency as an etiological agent in our study. Further studies and investigations are needed in this aspect.

The role of hyperlipidemia as an etiology of stroke in children is controversial. Abram *et al.*, (1996) did a study on lipoprotein and apolipoprotein abnormalities in 42 children with idiopathic ischemic stroke. He concluded that though lipid abnormalities are seen frequently in children with stroke, apolipoprotein assessment adds more significance than assessment of lipid profile alone (Gluek *et al.*, 1982; Abram *et al.*, 1996). In our study, we could not identify any abnormality in lipid profile.

Heart disease is identified as an important etiology in development of stroke (Nagaraja *et al.*, 1994; Obama *et al.*, 1994; Schoenberg *et al.*, 1978; Awada *et al.*, 1994; Gluek *et al.*, 1982; Abram *et al.*, 1996; Solomon *et al.*, 1970). Congenital heart diseases especially cyanotic congenital heart disease can cause thromboembolic episodes (12.8%) and brain abscess (13.6%) (Kalra *et al.*, 2000). Echocardiography as a diagnostic tool is helpful in identifying congenital and acquired heart diseases. It also helps to identify a source of emboli. Clinically silent heart diseases like mitral valve prolapse (MVP), persistent foramen ovale (PFO) have been identified as predisposing condition for stroke. The role of conventional echocardiography is been questioned by newer modalities like Transesophageal echocardiography and contrast Transcranial Doppler sonography. These investigations are considered superior to conventional echocardiography (Kittner and Adams, 1996; Lechat *et al.*, 1988).

In our study heart disease was not found by clinical examination. Echo should be done for all patients with idiopathic stroke with special attention to identify any otherwise missed condition like mitral valve prolapse. Reports of clinically silent MVP and paradoxical embolization through PFO resulting in stroke are available in literature (Kittner and Adams, 1996; Lechat *et al.*, 1988; Hanna *et al.*, 1994; Burrows *et al.*, 1996).

CT scan has revolutionized the field of neuroradiography. An immediate CT following a stroke will help to differentiate infarction from hemorrhage. It also identifies a space occupying lesions. An inflammatory condition or arteriovenous malformation can be identified by contrast studies. CT scan to a extent can prognosticate the illness.

MRI scan is useful in identifying brainstem lesion and early infarction. MR is considered superior to CT scan. Conventional cerebral angiography is a definite method to visualize extracranial and intracranial vasculature, signs of dissection, aneurysms and signs of vasculitis.

MR angiography (MRA) is a very sensitive non-invasive tool for identifying large vessel disease and to an extent small vessel and medium vessel disease. MRI and MRA can be combined together to get excellent results. However, these investigations are expensive, not easily available and time-consuming (Burrows *et al.*, 1996; De *et al.*, 2002).

In our study we did cranial CT study for 18 cases and MRI scan in 2 cases. CT scan was abnormal in 16 cases and MRI scan abnormal in one case. Abnormal findings were noted in 85% of cases. Similar high utility of CT scan has been observed by Obama *et al.*, (1994), Hartfield *et al.*, (1997) and Nagaraja *et al.*, (1994).

Radiologically middle cerebral artery has been involved in 80% of our cases. Shirane *et al.,* (1992), Nagaraja *et al.,* (1994) also made similar observations.

Traditionally ischaemic stroke was more common than hemorrhagic stroke (Giroud *et al.,* 1997; Nagaraja *et al.,* 1994; Obama *et al.,* 1994; Schoenberg *et al.,* 1978; Awada *et al.,* 1994; Giroud *et al.,* 1995; Al Sulaiman *et al.,* 1999) 85% of our cases showed ischaemic stroke. Hemorrhagic stroke was not seen in our study. 5 cases had associated porencephalic cyst, 3 cases had gliotic changes, 2 cases had cerebral atrophy and basal ganglia was involved in 3 cases (15%). Giroud *et al.,* (1997) found infarction in basal ganglia in 8 of 17 cases (47%).

The etiological spectrum of stroke in children differs from adults (Giroud *et al.,* 1997). The important risk factors in adults such as hypertension, diabetes, alcohol abuse and smoking do not appear frequently in children. The risk factors for stroke in children are multiple. These multiple risk factors may co-exist in one patient. Hence, identification of the predisposing condition as well as co-existing risk factor is important for better management. Even in the best of the center, etiology could not be identified in $1/6^{th}$ of cases (Giroud *et al.,* 1997; Nagaraja *et al.,* 1994; Obama *et al.,* 1994; Schoenberg *et al.,* 1978; Awada *et al.,* 1994; Giroud *et al.,* 1995).

Stroke may be secondary to arterial or venous thrombosis, embolization, hemorrhage and other miscellaneous conditions.

Arterial thrombosis, usually occurs secondary to heart disease, infection, iron deficiency anemia, hematological abnormalities, metabolic disorders and in certain syndrome like Down's syndrome and Williams syndrome. Venous thrombosis occurs secondary to infection, dehydration and other hypercoagulable states (Kirkham, 1999).

Trauma, hematological abnormalities like idiopathic thrombocytopenic purpura, leukemia and hemophilia and congenital malformations like aneurysm and AVM can lead to hemorrhagic stroke (Kirkham, 1999).

Infectious causes for stroke assume particular attention in our society. Infections can be a direct etiologic agent as well as a precipitating event for stroke in many prothrombotic conditions (De Veber, 2002; Grau *et al.,* 1995). Bacterial meningitis caused by Pneumonia and influenza, Meningococci cause stroke by spread of meningeal inflammation to involve walls of intracranial vessels resulting in thrombosis.

In our study one case was diagnosed of pyogenic meningitis caused by Pneumoniae. One case had tuberculous meningitis with facial and abducent nerve involvement. The thick exudates formed in tuberculous meningitis cause occlusion or arteritis of large vessels in circle of Willis and middle cerebral artery. Arteritis of small vessels produces microinfarction.

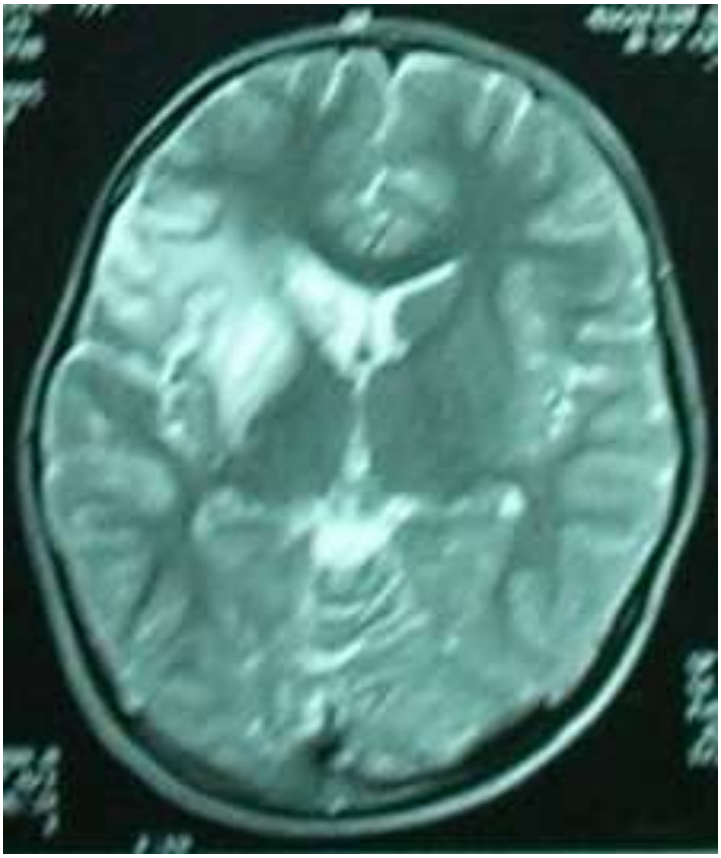
One case had viral encephalitis in our study. The microbiological diagnosis could not be made out due to lack of lab facilities. Enteroviruses are responsible in more than 80% of pediatric cases. Herpes virus and Mumps virus are also reported etiological agents (Charles, 2004). Varicella zoster is known to produce stroke (Takeoka and Takahashi, 2002). HIV virus is identified as an important etiological agent (Phillippet *et al.,* 1994; Park *et al.,* 1990; Visudtibhan *et al.,* 1999). It is reported to cause arteritis with fusiform aneurysms and arterial sclerosis with vascular occlusion (Shah *et al.,* 1996). We have not recorded any HIV positive cases in our study. We have screened for HIV only when there was a clinical suspicion. We recommend screening of all cases for HIV in future studies.

One child who had road traffic accident showed infarction involving right MCA territory. The role of slight head trauma before the onset of stroke is another feature in children, as observed by Shirane *et al.,* (1992) Even relatively minor head and neck trauma may cause shear injury of small penetrating vessels (Giroud *et al.,* 1997; Shah *et al.,* 1996).

6 cases (30%) developed weakness within 2 yrs, did not have any significant associated symptoms. Their cranial CT showed infarction. Further investigations like angiographic studies and metabolic screening were warranted in these cases.

In 3 cases, hemiparesis was noticed during 3 months – 6 months of age without associated seizures and mother had gestational diabetes in two cases and PIH in other, their CT scan showed ischemic stroke.

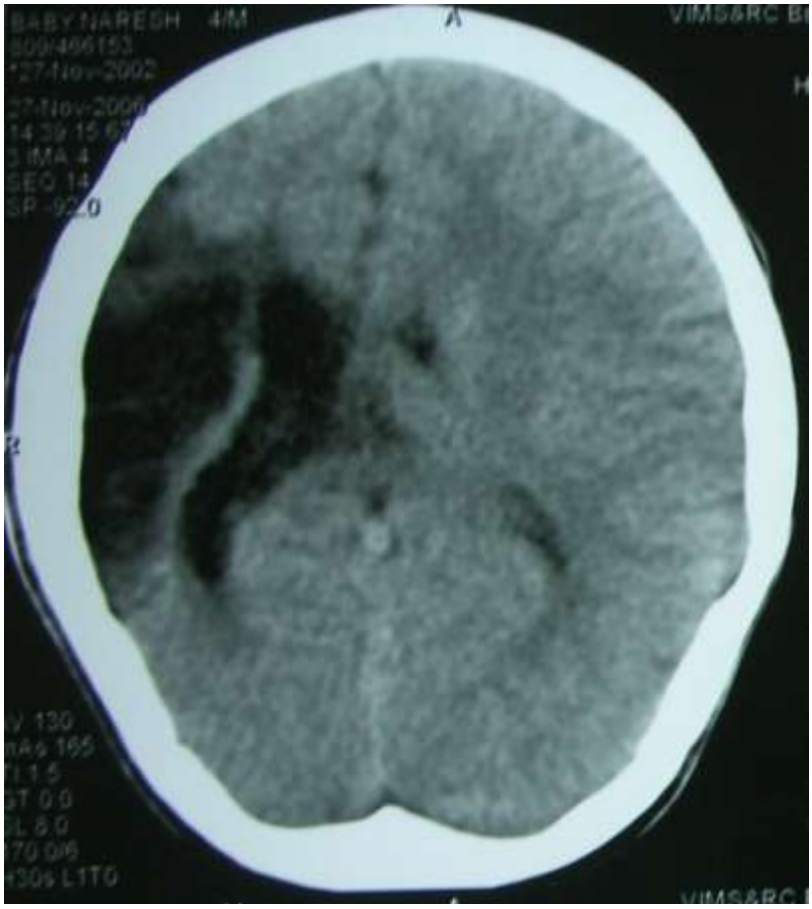
Whether it was perinatal stroke or postnatally acquired could not be made out. 2 cases had birth asphyxia and hemiplegia developing within 1year of age without seizures.



Infarction of Right MCA Territory

Old Infarct of Right MCA Territory

Research Article



Right MCA territory infarct with gliosis

In 5 cases (25%) cause could not be identified. Similar problems in establishing diagnosis in about 20-50% of cases have been faced in most of studies (Kirkham, 1999; Giroud *et al.*, 1997; Nagaraja *et al.*, 1994; Obama *et al.*, 1994; Schoenberg *et al.*, 1978; Awada *et al.*, 1994; Giroud *et al.*, 1995; Al Sulaiman *et al.*, 1999). However, we are not in a position to comment emphatically in this aspect as these children needed further investigations. This was not possible in our study due to lack of laboratory facilities and economic constraints. Though the incidence of stroke has increased over years mortality rates have come down by 58% over last 20 years. This has been possible with better understanding of pathophysiology of the disease. The early recognition of risk factors and better management is done in recent days. Newer drugs and improved surgical procedures have helped the clinicians to manage cases better.

Conclusion

Onset of stroke was more common within 2 years of age (75% of cases). Right-sided weakness was more common than left sided. Acute onset of hemiplegia was more common (60%). Fever was the commonest preceding symptom (50%) followed by convulsions (30%) and variable levels of altered sensorium (25%). Behavioural problems were seen in 25% of cases. Speech was affected in 40% cases. Asymmetry of affected limb was seen in 70% of cases. Cranial nerves were affected in 25% of cases. Facial nerve was the most commonly affected cranial nerve. Anemia was recorded in 55% of cases. Cranial CT yielded good results (85%). Infarction was noticed in 85% of cases. Other findings were cerebral atrophy, gliotic changes and porencephalic cysts. CNS infections were noticed in 3 cases, trauma in 1 case and perinatal insult could be found in 5 cases. Etiology could not be found in 11 cases. Limitations of this study were small sample size and inability to investigate all cases completely due to lack of resources.

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