



Original Research Article

An observational cross-sectional study of clinical profile of posterior circulation ischemic stroke in a tertiary care teaching hospital in Eastern India

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ABSTRACT

Introduction and Aim: Posterior circulation strokes account for approximately 15% of all strokes with diverse clinical presentation. They are different from anterior circulation strokes, with reference to risk factors, clinical features, management strategy and prognosis. We conducted a study in a tertiary care teaching hospital in Eastern India to understand the clinical profile of patients with posterior circulation ischemic stroke.

Materials and Methods: The study was conducted at Hi-Tech Medical College and Hospital, Bhubaneswar, Odisha, with a total of 282 patients during the period from January 2020 to June 2021 (Eighteen months). A detailed medical history and clinical examination aided with neuro-imaging was done in all patients.

Results and Conclusion: Incidence of posterior circulation ischemic stroke was 16.2%. The male to female ratio being 2.27:1, the mean age at presentation was 54.4 (\pm 13.6) years. Diabetes, hypertension, dyslipidemia and tobacco use were identified as the major risk factors. The common clinical manifestations were motor disturbances, vertigo, gait ataxia, cranial nerve deficits, altered sensorium and visual disturbances. Infratentorial infarcts were seen more frequently and most common anatomical site of involvement was cerebellum (30.5%). Large artery diseases (58.8%) were the most common aetiological causes and 15.6% had cardioembolic source according to TOAST Criteria. Posterior cerebral artery involvement was the most common (43.6%) finding and the incidence of mortality was 6.3% noted in our series.

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1. Introduction

Brain stroke remains one of the major causes of mortality and long term morbidity in the society. It has a high impact on the personal, psychological, social and economic status of the patient as well as the caregivers. After cancer and ischemic heart disease, cerebral stroke is the third most common cause of death in the developed world.¹ This is very common in developing countries like India.²

Cerebral stroke can be either hemorrhagic or ischemic. The World Health Organization (WHO) defines stroke as “rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than vascular origin”.³

Posterior circulation strokes account for 10 to 15% of all cerebral strokes.⁴ Posterior circulation territory includes anatomical sites like occipital, medial temporal lobe, thalamus, brainstem, cerebellum. Posterior circulation blood flow consists of two vertebral arteries, one basilar

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artery and two posterior cerebral arteries through many short penetrating and circumferential branches.⁵ Posterior circulation stroke differs from anterior circulation stroke with reference to risk factors, clinical symptomatology and prognosis. Clinical features of posterior circulation stroke encompasses fluctuating sensorium, cranial neuropathy, visual disturbances, cerebellar ataxia, etc. They have been described as various clinico-anatomical syndromes like Claude's, Weber's, Balint's, lateral medullary, medial medullary, locked in state and top of basilar syndrome.⁶

There are a few hospital based studies to delineate detailed risk factors, clinical profile, vascular territory involvement, prognosis for posterior circulation ischemic strokes in India. We report 282 patients, by far the largest no of cases with posterior circulation ischemic stroke from India.

2. Material and Methods

An observational cross-sectional hospital based study was conducted in the Department of Medicine and Neurology at Hi-Tech Medical College and Hospital, Bhubaneswar, Odisha from January 2020 to June 2021 (Eighteen months). An informed consent was taken from all the patients/eligible relatives. Ethical Clearance was obtained from the Institutional Ethical Committee.

During this period, all patients with posterior circulation ischemic cerebral stroke, admitted as inpatient care were included. Clinical history was documented and examined clinically. All the patients were investigated for Complete blood count, urine analysis, fasting blood sugar, renal function test, liver function test, serum electrolytes, lipid profile, chest radiography, ECG, 2-D ECHO and Carotid Doppler study. MRI Brain scan was done for all patients and analyzed with the help of neuroradiologist. Diagnosis was made on the basis of medical history, physical examination and neuro imaging. Transient ischemic attack was defined as the abrupt onset of focal neurological deficit lasting for less than 24 hours.

Informed consent was obtained from the patients or their close relatives. Patients/ Relatives were interviewed within 48 hours of admission and at the time of discharge to collect relevant data.

The data was collected in a specially pre-designed structured proforma. The demographic data, risk factors, clinical findings, treatment and any complications during hospital stay were noted. Stroke onset symptoms, National Institutes of Health Stroke Scale Score (NIHSS)⁷ were noted.

2.1. Inclusion criteria

Patients with clinical stroke syndrome compatible with involvement of posterior circulation territory with the help of neuro imaging (MRI of brain), were included.

2.2. Exclusion criteria

Cases with hemorrhagic lesions, non vascular lesions (malignancy, inflammatory, infective, congenital) and concomitant anterior circulation stroke were excluded. Patients with no relatives or friends who can provide reliable history could not be included.

The aetiology of stroke is classified according to the Trial of Org in Acute Stroke Treatment (TOAST) classification.⁸ The categories include large-vessel atherosclerosis (atherosclerosis of large arteries with stenosis), cardioembolism, small-vessel disease (lacunar syndrome and ischemic lesion <1.5 cm), other determined causes and undetermined causes (negative evaluation or incomplete evaluation).

Ischemic strokes were classified according to the vascular territory involvement on MRI of brain scan and magnetic resonance angiographic studies. These subgroups include posterior cerebral artery (PCA), anterior inferior cerebellar artery (AICA), posterior inferior cerebellar artery (PICA), superior cerebellar artery (SCA) and top of basilar artery (TOB).

2.3. Statistical analysis

A statistical analysis was performed by Statistical Package for the Social Science (SPSS) version 16.0 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics were used and results were expressed in absolute number and percentage.

3. Results

A total of 1803 patients were admitted to the medicine/neurology department with ischemic cerebral stroke during the study period. Out of which, 293 (16.2%) patients, presented as posterior circulation ischemic stroke. Eleven patients were excluded due to inadequate history or neuroimaging.

In the study cohort of 282 patients, 196 (69.5%) were males and 86 (30.5%) were females. The male to female ratio of stroke was 2.27:1. The age ranged from 22 to 87 years with mean age of 54.4 (\pm 13.6) years. Stroke was more common in the middle aged and elderly group as 140 patients (49.6%) were from 40 to 59 age group. [Table 1] In our study group 56(19.8%) patients were young stroke (< 45 years)

Patients presented to hospital with mean duration of 15.7 (\pm 12.26) hours after stroke onset. Ten patients presented within window period (< 4.5 hour) for intravenous thrombolysis.

The most common risk factors of stroke were hypertension [176 (62.4%)] and diabetes [(122(43.2%)). [Table 2]. Some rare risk factors like systemic vasculitis (SLE, APLA syndrome), Congenital Prothrombotic state (Protein C deficiency, Factor V Leiden mutation), oral contraceptive uses, etc were also noted in this study.

Table 1: Age and gender distribution of the study population: n=282

Variables	Male (%)	Female (%)	Total (%)
	196(69.5%)	86(30.5%)	282
Age in years			
20 – 39	16(8.2)	10(11.6)	26(9.2)
40 – 59	108(55.1)	32(37.2)	140(49.6)
60 – 79	67(34.2)	41(47.7)	108(38.3)
≥ 80	5(2.5)	3(3.4)	8(2.8)

Table 2: Predisposing /risk factors in the study cohort

[Predisposing / Risk Factors	Number of patients, n=282 (%)
Hypertension	176 (62.4%)
Diabetes	122(43.2%)
Dyslipidemia	93 (32.9%)
Tobacco abuse	66 (23.4%)
Ischemic heart disease	62(21.9%)
Past h/o ischemic stroke	48(17.02%)
Alcoholism	32 (11.3%)
Significant carotid/ vertebral disease	32 (11.3%)
Past h/o TIAs	24 (8.5%)
Associated Peripheral Vascular disease	22(7.8%)
Documented atrial fibrillation	18(6.3%)
Rheumatic Heart disease	15 (5.3%)
Obesity	32(11.3%)
migraine	6 (2.1%)
OC Pill uses	5 (1.7%)
Prosthetic cardiac valve	5 (1.7%)
Systemic Vasculitis	4(1.4%)
Congenital Prothrombotic state	2 (0.7%)

As patient had multiple stroke risk factors at the time of hospitalization, the total number of risk factors was more than the total number of patient.

The most common neurological symptoms/ sign were motor dysfunction [145 (51.4%)], altered sensorium [112 (39.7%)] and ataxic gait [98 (34.7%)]. [Table 3] A large number of patients presented with visual dysfunction/ diplopia [85(30.1%)], due to occipital lobe and brain stem involvement. The mean NIHSS score during presentation was 18.06 (±8.68).

All the patients, in our study, underwent MRI of brain which was reviewed by neuroradiologist. Infra tentorial stroke lesions were commoner than supratentorial lesions [158 (56.02%) v/s (92 (32.6%)). [Table 4] The most common anatomical site of involvement was Cerebellum [86(30.5%)].

Large artery diseases (58.8%) were the most common aetiological causes according to TOAST Criteria. [Table 5]. Posterior cerebral artery territorial involvement was most common (43.6%), followed by PICA involvement (29.1%).[Table 6]

Table 3: Neurological symptoms/signs at presentation

[Neurological symptoms	Number of patients, n=282 (%)
Motor weakness	145(51.4%)
Vertigo	112(39.7%)
Ataxia/ Gait unsteady	98(34.7%)
Cranial nerve deficits	98(34.7%)
Altered sensorium	95(33.6%)
Visual symptoms/ Diplopia	85(30.1%)
Headache/ Head reeling	55(19.5%)
Speech difficulty	72(25.5%)
Requiring assisted ventilation/ Intubation	52(18.4%)
Nausea/ vomiting	48(17%)
headache	35(12.4%)
Sensory disturbances	33(11.7%)
Bladder & Bowel dysfunction	32(11.3%)
Nystagmus	32(11.3%)
Bulbar dysfunction/ dysphagia	28(9.9%)
Haemodynamic instability/ shock/ requiring vasopressures etc	26(9.2%)
Memory disturbances	25(8.8%)
convulsion	15(5.3%)
Meningeal irritation	12(4.2%)
Fever	9(3.1%)

Table 4: Distribution of anatomical Lesions as per MRI of brain (Multifocal ischemic lesions lead to more number of site involvement in MRI as compared to number of patients)

Anatomical sites	Number of patients n=282 (%)
Infratentorial	158 (56.02%)
Cerebellum	86(30.5%)
Pons	65(23.04%)
Midbrain	52(18.4%)
Medulla	34(12.05%)
Supratentorial	92 (32.6%)
Occipital lobe	73(25.8)
Temporal lobe	45(15.9%)
Thalamus	33(11.7)
Infra & Supratentorial	32 (11.3)

Table 5: Etiology of posterior circulation ischemic stroke according to TOAST Criteria⁸

Stroke subtypes	Number of patients n=282 (%)
Large artery disease	166 (58.8%)
Small vessel disease	49(17.3%)
Cardio embolic stroke	45(15.6)
Other determined causes	8 (2.8%)
Undetermined causes	14 (4.9%)

Patients were admitted in hospital for a mean of 11.4 (± 6.13) days. Three patients were treated with intravenous thrombolysis (rTPA). Suboccipital decompressive craniectomy was done in 5 patients. All the patients were treated with antiplatelets (most common Aspirin 64.5%) and lipid lowering agent (most common Atorvastatin 66.6%) [Table 7]

Most common in hospital complications of stroke, were observed as electrolyte imbalance [52(18.4%)] followed by aspiration pneumonia [32 (11.3%)]. [Table 8] The mortality was noted in 18 (6.3%) patients in this study group.

Table 6: Posterior circulation vascular territory involvement

Vascular Territory	Number of patients n=282 (%)
PCA	123 (43.6%)
PICA	82(29.1%)
SCA	35(12.4%)
AICA	10 (3.5%)
TOB	3 (1%)
Nonlocalizable	29(10.3%)

Abbreviations: PCA- Posterior cerebral artery ; PICA- posterior inferior cerebellar artery; SCA- superior cerebellar artery; AICA- anterior inferior cerebellar artery; TOB- top of basilar artery

Table 7: Treatment with the various drugs for the indoor patients

Drugs	Number of patients n=282 (%)
Antiplatelets	
Aspirin	182(64.5%)
Aspirin + Clopidogrel	56(19.8%)
Clopidogrel	44(15.6%)
Lipid lowering agents	
Atorvastatin	188 (66.6%)
Rosuvastatin	94(33.3%)
Fenofibrate	15(5.3%)
Anticoagulants	
Low molecular weight heparin (LMWH)	31(10.9%)
Heparin	24(8.5%)
Warfarin	22(7.8%)
NOACs	10(3.5%)
Anti oedema drugs	
Mannitol	93(32.9%)
3% normal saline	52(18.4%)
Glycerine	22(7.8%)
Anti Epileptic drugs	
Levetiracetam	42(14.8%)
Phenytoin	11(3.9%)

4. Discussion

The study was conducted in the department of medicine in collaboration with the department of neurology, Hi-Tech

Medical college & Hospital, Odisha on 282 patients of posterior circulation ischemic stroke admitted over eighteen months duration.

We encountered posterior circulation ischemic stroke in 16.2% of total stroke patients in our study, as comparable to previous studies by Mehndiratta et al⁹ (11.3%), Richard et al¹⁰ (14.8%) and Jones et al¹¹ (17%).

In our cohort the incidence of posterior circulation ischemic strokes, below 60 years age group was 58.8% similar to an Indian study by Kora SA et al (56%).¹² These findings suggest posterior circulation ischemic stroke affecting the younger population in India. Incidence of stroke was more in males as compared to females (Male: Female - 2.27:1) which was in accordance with previous studies like Kora. S.A et al¹² and R.B.Libman et al.¹³

Incidence of infratentorial ischemic strokes was high (56.02%) as compared to supra tentorial lesions and use of MRI scan aided in identifying the infratentorial lesions promptly. CT scan is a poor diagnostic tool compared to MRI scan, especially for infratentorial lesions.¹⁴ The incidence was comparable to Bogousslavsky et al study (70%).¹⁵

In our series, the incidence of HTN, Diabetes, hyperlipidemia and ischemic heart disease were higher, suggesting significant atherosclerotic risk factors. They were comparable with different studies by E.Ratnavalli et al,¹⁶ Capalan et al,¹⁷ Uma et al,¹⁸ Kora.S.A et al¹² and Mehndiratta et al.⁹[Table 9]

The clinical manifestations encountered in our study are comparable to the Kora SA et al¹² and Patrick et al¹⁹ studies.[Table 10] The incidence of visual disturbance was higher in the present study (30.1%) compared to Patrick et al¹⁹ (13%) which can be due to the presence of larger number of occipital infarcts in our study (25.8% V/s 8%). The major clinical symptoms like motor weakness, vertigo, ataxia and cranial nerve deficits were attributable to the affection of brain stem, long tracts, cranial nerve nuclei and cerebellar connections. The varied clinical manifestations probably due to difference in infarct size, location, presence of collaterals and vascular territory involvement in different studies. In our patients, headache and vomiting were commonly seen as suggested by previous studies.¹³ These symptoms are commonly seen, than in anterior circulation strokes.¹³

In our study, 58.8% patients had large artery disease and 15.6% had a cardio-embolic aetiology. Large artery disease stroke was present in 32% of patients in New England Medical Center Posterior Circulation Registry, while 24% had cardiac source of embolism.²⁰ Higher incidence of large artery involvement in our patients and in the study by Mehndiratta et al⁹ could be due to the more frequent intracranial large artery atherosclerosis in Asians as compared to whites which has been suggested by many studies.²¹⁻²³

Table 8: Various complications encountered during hospital stay

Anatomical sites	Number of patients n=282 (%)
Electrolytes imbalance	52(18.4%)
Aspiration pneumonia	32(11.3%)
Cardiac arrhythmia	21(7.4%)
Pressure ulcers	18(6.3%)
Urinary tract infection	18(6.3%)
Upper GI haemorrhage	11(3.9%)
Haemorrhagic conversion	10 (3.5%)
Depression	10(3.5%)
Deep vein thrombosis	8(2.8%)
Falls after stroke	5 (1.7%)

Table 9: Comparisons of various stroke risk factors in percentages among different studies

Risk factors	E Ratnavalli et al ¹⁶	Caplan et al ¹⁷	Uma et al ¹⁸	Kora.S.A et al ¹²	Mehndiratta et al ⁹	Present study
Hypertension	23	61	21	37	51	62.4
Diabetes	20	25	35.5	05	24	43.2
Tobacco abuse	25	35	35.5	52	25	23.4
Alcohol	25		19.7	21	5	11.3
Hyperlipidemia		25	44.4	10	17	32.9
RHD			10.5	05	2	5.3
IHD	05	35	17.1	05	14	21.9
obesity					8	11.3
Prosthetic heart valve	03					1.7
Peripheral vascular disease		10				7.8
OC pill use			39.1		0	1.7
migraine			11.8		0	2.1

Table 10: Comparisons of presenting neurological signs/ symptoms of stroke in percentages among different studies

Neurological symptoms/ signs	Patrick et al ¹⁹	Kora.S.A et al ¹²	Mehndiratta et al ⁹	Present study
Consciousness Impaired	47	63		33.6
Speech Disturbance	30	37		25.5
Cranial nerve involvement	64	53	26.2	34.7
Motor disturbances	43	63	42.5	51.4
Cerebellar ataxia	29	37	48.7	34.7
Nystagmus	29	32		11.3
Sensory disturbances	17	05		11.7
Meningeal irritation		05		4.2
Vertigo	30	42	56.2	39.7
Headache		57	31.2	12.4
vomiting	30	42	41.25	17
Visual disturbances	13	47	20	30.1

The mortality noted in various studies were (25.6%) Patrick et al,¹⁹ (17%) Uma et al¹⁸ and (27.5%) Jones et al¹¹. Incidence of mortality (6.3%) in our series is less comparing with other studies, may be related to advancement in the neuro critical care and more number of mild to moderate strokes.

5. Limitation(s)

This study may not be a true reflection of posterior circulation stroke in the community since it has been undertaken in a tertiary care hospital and there can be a referral bias of presentation. Further studies would help to know more about the prognostic markers of mortality in posterior circulation stroke in relation to various risk factors and clinical features.

6. Conclusion

The present study from Eastern India describes the various risk factors, clinical manifestations, subtypes of stroke and management of posterior circulation ischemic strokes. Our study demonstrated the frequent occurrence of posterior circulation ischemic stroke in a relatively younger age group in India. There are higher percentages of large artery disease and low cardio-embolic strokes in our study cohort. Our study suggest that pattern of risk factors, stroke subtypes, vascular territory and lesion topography in posterior circulation strokes might have environmental, regional and ethnic variations.

7. Conflict of Interests

There are no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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