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Original Research Article

Study on posterior circulatory stroke characteristics and clinico-radiological imaging

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ABSTRACT

Background: Stroke research and clinical trials have focused mainly on anterior circulation stroke (ACS). Since clinical characteristics, mechanisms, and risk factors of posterior circulation stroke (PCS) have been reported different from ACS, more PCS studies are required.
Methods: A Prospective, observational, Clinical study. All patients presenting to the department of general medicine and neurology of saveetha medical college from august 2021 to January 2023 with new onset neuro-deficit. Inclusion criteria is patients age 18 years or older and Clinical profile, radiological finding which is suggestive of acute PCS. Radiological imaging was done in detail to assess the artery involved and area affected.
Results: Most common associated risk factors were hypertension (61%), alcoholism (33%) and smoking (32%). Most common presenting clinical symptoms of cases with PCS are giddiness (59%), left/ right sided weakness (48%). Posterior cerebral artery was involved in 45% of the patients. The next common involvement was that of the posterior inferior cerebellar artery (38%). Most common area involved was brainstem, cerebellum.
Conclusions: This study describes the pattern of risk factors and clinical characteristics of PCS. Males were affected more than females. Age group commonly involved was above sixty years. Hypertension, alcoholism, diabetes and smoking contributed the major risk factors. Giddiness was commonest symptom at the onset. Most of the patients had clinical signs of cerebellum and brainstem lesions. The territory commonly involved was mid-brain, cerebellum, thalamus, occipital and temporal lobes.

Keywords: Posterior circulatory stroke, Cerebellum, Brainstem, Hypertension, Diabetes, Giddiness

INTRODUCTION

Stroke is defined as loss of brain function due to a disturbance in the blood supply to the brain either due to ischaemia or haemorrhage. Some of the recent studies have elucidated the stroke pattern to considerable extent in our country with a prevalence rate of 471.58/100000 population. A study identified that 7% of medical and 45% of neurological admissions were due to stroke with a fatality rate of 9% at hospital discharge and 20% at 28 days.

Global burden of disease programme under the world health organization showed that the mortality due to stroke is different in different countries with the low income countries being affected the most. Major part of the resource consumption by stroke patient occurs in terms of loss of manpower and financial burden.

Stroke claims a life every 6 seconds. From 2000-2008, the overall stroke incidence rates in low to medium income countries exceeded that of incidence rates seen in high income countries by 20%. According to WHO estimation, by 2050 nearly 80% of stroke cases may occur in low and middle-income countries like China and India.[1]

After coronary heart disease (CHD) and cancer of all types, stroke is the third commonest cause of death

worldwide. Large vessel intracranial atherosclerosis is the commonest cause of ischaemic stroke in India. The common risk factors, that is, hypertension, diabetes, smoking, and dyslipidemia, alcohol consumption, elevated homocysteine levels, obesity, cardiac disease are quite prevalent and inadequately controlled; mainly because of poor public awareness and inadequate infrastructure.[2]

The non modifiable risk factors are age, gender, race/ethnicity, family history, genetics. stroke syndromes are classified into ACSs and PCS, based on the blood supply. The internal carotid artery and its branches comprise the anterior circulation and paired vertebral artery, basilar artery and paired posterior cerebral artery constitutes the posterior circulation. Stroke syndromes of the posterior circulation account for approximately 20% of all strokes. Though there have been many studies of stroke around the world, studies pertaining to the subset of PCS are still scarce There are specific signs and symptoms found in PCS patients which help to differentiate them from non-PCA strokes. These are dizziness, nausea and vomiting, diplopia, dysarthria, dysphagia and headache whereas the signs are ataxia, nystagmus, visual field defects and cranial nerve palsies.[3] Cumulative information on demographic characteristics, clinical profile and radiological profile needed to be looked into.

Stroke research and clinical trials have focused mainly on ACS. Since clinical characteristics, mechanisms, and risk factors of PCS have been reported different from ACS, more PCS studies are required.

METHODS

Study population is all patients presenting to the department of general medicine and neurology of Saveetha medical college, Chennai from August 2021 to January 2023 with new onset neuro-deficit. A prospective, observational, clinical study. A total of 30 patients were included in the study with age 18 years or older and clinical profile, radiological finding which is suggestive of acute PCS. Exclusion criteria is age less than 18 years and patients who are not satisfied with clinical and radiological profile diagnostic criteria. Patient details: age, sex, clinical presentation and risk factors like hypertension, diabetes mellitus, past history of TIA, hypercholesterolemia, valvular heart disease, atrial fibrillation, smoking and alcoholism were recorded. History of stroke including the time of onset of stroke. All the patients were investigated with CT brain plain. MR diffusion was done whenever required. Radiological imaging was done in detail to assess the artery involved and area affected in the PCS. Ethical committee approval obtained from institutional ethics committee.

Statistical analysis

All the data was noted down in a pre-designed study proforma. Qualitative data was represented in the form of frequency and percentage. Quantitative data was represented using Mean ± SD. Univariate and multi-variate analysis was done to identify predictors of poor outcome in PCS. A $p<0.05$ was taken as significant. Results were graphically represented where deemed necessary. SPSS Version 21.0 was used for most analysis and Microsoft excel for graphical representation.

RESULTS

Mean age of the study subjects was 57.8 years with 46% of the cases were over 60 years of age. Male preponderance was seen in the study group with 63% males to 37% females. Most common associated risk factors were Hypertension (61%) and history of alcoholism (33%) and smoking (32%). Other risk factors include dyslipidemia (25%), diabetes (17%) and history of IHD (9%).

Table 1: Distribution of the study groups as per age group.

Age group (Years)	N	Percentages (%)
≤40	2	7
41-50	5	16
51-60	9	31
61-70	12	39
>70	2	7
Total	30	100

Table 2: Distribution of the study groups as per gender.

Gender	N	Percentages (%)
Female	11	37
Male	19	63

Table 3: Distribution of study cases as per presence of risk factors.

Risk factors	N	Percentages (%)
Hypertension	18	61
Alcohol	10	33
Smoking	9	32
Dyslipidemia	7	25
DM	5	17
TIA	3	11
IHD	3	9

Presenting clinical symptoms of cases with PCS include: giddiness (59%), left/ right sided weakness (48%), headache (27%), visual field defects (25%), altered sensorium (16%), hemi-sensory loss (15%) and seizures (9%). Cerebellar signs were present in 38% cases while cranial nerve involvement was seen in 35% cases.

Radiological imaging had been evaluated in detail to assess the artery involved in the PCS. There was a predominant involvement of the distal arterial system.

Posterior cerebral artery was involved in 45% of the patients, which also included the thalamic artery and other branches. The next common involvement was that of the posterior inferior cerebellar artery (38%), which was a branch of the vertebral artery. Basilar artery occlusion was found in about one-fifth of the patients (19%). Most common area involved was brainstem (40%), cerebellum (36%) as well as the thalamus/ medial temporal/ occipital (24%).

Table 4: Distribution of study cases as per presenting clinical symptoms.

Clinical features	Percentages (%)
Giddiness/vomiting``	59
Weakness	48
Cerebellar signs	38
CN involvement	35
Headache	27
Visual field defects	25
Altered sensorium	16
Hemisensory loss	15
Seizures	9

Table 5: Distribution of study cases as per location of infraction.

Artery involved	Percentages (%)
Posterior cerebral	45
Superior cerebral	17
Anterior cerebral	12
Posterior inferior	38
Basilar	19
Vertebral	11

Table 6: Distribution of study cases as per areas involved.

Areas involved	N	Percentages (%)
Cerebellum	11	36
Brainstem	12	40
Thalamus/medial temporal/occipital	7	24
Total	30	100

DISCUSSION

Approximately 80% of strokes are ischaemic, with posterior circulation infarction (PCI) accounting for 20% of these cases. PCS accounts for approximately 20% of all strokes with varied clinical presentation, which differ from strokes in anterior circulation, with reference to aetiology, clinical features, and prognosis. Early diagnosis of stroke is essential so that appropriate preventive therapies may be instituted.

Present study was conducted on 30 patients of PCS, to study the clinical features, radiological imaging and risk factors. Demographic details, Mean age of the present study subjects was 57.8 years with 46% of the cases were over 60 years of age with Male preponderance, there were 63% males to 37% females. Similar demographic characteristics were observed in the BASICS study in terms of the elderly age group [mean age of 63 years] and male predominance [65%].[4] Similar age and gender distribution has also been observed by Dubey et al.[5] There were 39 (78%) male and 11 (22%) female patients. The ratio of male to female is 4:1. The age distribution ranged from as low as 30 years to upto 93 years, with the majority being males of elderly age group and the mean age was 61 years in their study. These parameters are also in accordance with Chengdu stroke registry in which the mean age was 61.4 years and male predominance.[6] Published data from the Tufts New England medical centre PCS registry document showed that 58% of patients are male and 42% female.[7] Incidence was more in males compared to females was in accordance with other studies like Cristina et al study and Libman et al study.[8,9]

Many studies of risk factors for stroke have not considered pathological and etiological subtypes separately and often have not even fully differentiated between subarachnoid haemorrhage, intracerebral haemorrhage, and cerebral infarction.[10,11] Of those studies that have categorised strokes as ischaemic or hemorrhagic, most have not subdivided ischaemic stroke according to the different clinical or etiological subtypes.[12,13] Some studies have compared the prevalence of risk factors between the different subtypes of ischaemic stroke and have reported important differences in the frequency of established vascular risk factors.[14,15] Arterial hypertension, the single most frequent stroke risk factor, showed a high prevalence in all stroke subtypes, except for combined other aetiologies. Hypertension is more common in microangiopathic stroke than in cardioembolism and its prevalence is also higher in stroke due to large stroke than in cardioembolic stroke.[16] In the Rochester Study, the prevalence of hypertension was not different among stroke subtypes, and diabetes mellitus was less common in atherothrombotic stroke than in lacunar and cardioembolic stroke.[17] The Oxfordshire community stroke project found no difference between lacunar and cardioembolic stroke regarding hypertension/ diabetes mellitus. Most common associated risk factors observed in the present study were hypertension (61%) and history of alcoholism (33%) and smoking (32%). Other risk factors include dyslipidemia (25%), diabetes (17%) and history of IHD (9%). Dubey et al reported hypertension (78%) and diabetes (48%) were the most common observed risk factors, others being dyslipidemia (46%) alcohol consumption (18%) smoking (24%) and heart disease (16%), the factors observed were similar to the present study, although there was variation in distribution, which can be attributed to the geographical differences in presence of various factors. In the another study by Mousavi et al the prevalence of hypertension as a major risk factor of stroke was higher in patients with PC stroke, but concerning the prevalence of diabetes mellitus as a risk factor for stroke, there was no difference between AC and PC strokes. They also observed hyperlipidemia as

a risk factor for AC and PC strokes and the prevalence was equal for both types. Similar risk factors have also been reported by Zeng et al they observed risk factors, with relative frequencies following the sequence: hypertension>current smoking>alcohol consumption >diabetes mellitus >hyperlipidemia>atrial fibrillation>coronary artery disease >heart valve disease >myocardial infarction.

Presenting clinical features of cases with PCS in present study included: giddiness (59%), left/ right sided weakness (48%), headache (27%), visual field defects (25%), altered sensorium (16%), hemi-sensory loss (15%) and seizures (9%). Cerebellar signs were present in 38% cases while cranial nerve involvement was seen in 35% cases. Most common area involved was brainstem (40%), cerebellum (36%) and thalamus/ medial temporal/ occipital (24%). Radiological imaging had been evaluated in detail to assess the artery involved in the PCS. There was a predominant involvement of the distal arterial system. Posterior cerebral artery was involved in 45% of the patients, which also included the thalamic artery and other branches. The next common involvement was that of the posterior inferior cerebellar artery (38%), which was a branch of the vertebral artery. Basilar artery occlusion was found in about one-fifth of the patients (19%). Large vessel infract was seen in 72% while lacunar infract was observed in 20% cases in present study.

Giddiness (27.5%) as the commonest symptom among PCS Motor involvement (72.5%) was commonest clinical feature among PCS followed by speech involvement and altered sensorium has also been reported by Dubey et al they reported dizziness and vomiting were the leading complaints during presentation occurring in 52% and 42% patients respectively whereas limb weakness and headache were the least common symptom present in 30% and 28% of the patients respectively. These findings are also in accordance to New England medical center posterior circulation registry where dizziness was the most common presenting symptom present in 47% of the patients followed by limb weakness in 38% of the patients and vomiting in 27% of the patients.[18] Giddiness as most common presentation has also been observed by Behera BP et al.[19] Similar findings were also observed by few other studies, Timothy et al. described vertigo without hearing loss as the commonest symptom in brain stem stroke syndromes.[20] Vertigo occurs both in small vessel and large vessel disease. Huans et al had found 30% of his patients had vertigo, they described pyramidal signs in 58% and cerebellar signs in 51%.

PCS is due to the involvement of cerebellum or its connections., as also observed in the present study. Vertigo in PCS is due to the involvement of vestibular nucleus or its connections. Vertigo is a predominant feature of lateral medullary syndrome and cerebellar stroke especially due to PICA and AICA territory involvement. Due to the high density of nuclei and tracts in the brain stem, vertigo is usually accompanied by the involvement of other cranial nerves and or long tracts. It has been reported that isolated episodes of vertigo continuing for more than 3 weeks are almost never caused by vertebra basilar disease.[21] A study from China by Shi et al analyzed clinical characteristics in 216 patients with PCS found dizziness in 33.8% which is comparable to our observations.[22] The above-mentioned study also demonstrated a relatively higher percentage of patients with motor weakness (81.9%) as compared to our study. The incidence of visual disturbance was 25% in present study which is more than these studies, which is attributed to the involvement of posterior cerebral artery, PCA and deep branches of MCA supply optic radiations. The lower part of optic radiations receives blood supply from the PCA. Upper part gets blood supply from MCA.

Ataxia in PCS is due to the involvement of cerebellum or its connections, which was the second common symptom in the present study, followed by headache, these findings are in accordance with Mehndiratta et al they also observed giddiness as the most common symptom in their study followed by Ataxia, headache, vomiting and visual defects with maximum involvement of posterior cerebral artery.[23]

Limitations

Limitations of this study were the size of the population which is very small. The study has been done in single centre. The study was carried out in a tertiary care centre, so hospital bias cannot be ruled out.

CONCLUSION

This study describes the pattern of risk factors and clinical characteristics of posterior circulation stroke. Males were affected more than females. Age group commonly involved was above sixty years. Hypertension, alcoholism, diabetes and smoking contributed the major risk factors, giddiness was commonest symptom at the onset. Most of the patients had clinical signs of cerebellum and brainstem lesions. The territory commonly involved was mid-brain, cerebellum, thalamus, occipital and temporal lobes.

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