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Original Research Article

Clinical profile and prognosis of patients with posterior circulation stroke

Kavita J. Rawat, Bhaskar S. Korde, Kavita S. Joshi*

Department of Medicine, Seth G. S. Medical College, Parel, Mumbai, Maharashtra, India

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***Correspondence:**
Dr. Kavita S. Joshi,
E-mail: kavitajoshi@kem.edu

ABSTRACT

Background: Posterior circulation stroke is less common than stroke involving the anterior circulation. An understanding of the Posterior circulation stroke phenomenology and mechanisms requires knowledge of neurovascular anatomy and of the structure-function relationships of this region of the brain. Identifying mechanisms of stroke is essential so that appropriate preventive therapies may be instituted.
Methods: A prospective study was conducted over a period of 1 year after obtaining permission from institutional ethics committee. Recently diagnosed cases of posterior circulation stroke from medicine and neurology wards were enrolled, who fulfilled inclusion criteria.
Results: Most common age for posterior circulation stroke in this study was 41-70 years of age with median age of 56.5 years. It is more common in males (55%) than females (45%). Ischemic posterior circulation stroke is more common (63.15%) than haemorrhagic posterior circulation stroke (36.85%). Most common presenting feature of posterior circulation was ataxia (77.3%). Most common risk factor for posterior circulation stroke was hypertension (60.5%) followed by dyslipidemia (55.26%). Most common site of involvement in ischemic posterior circulation stroke was cerebellum (37.5%) followed by occipital lobe (24%). Commonest site of bleed found was cerebellum (64.4%) followed by pons (35.6%). Mortality in posterior circulation stroke in present study was 15.78%.
Conclusions: Posterior circulation stroke present with a wide variety of symptoms. Episodes are often staggering and more protracted than those of anterior circulation stroke. Further studies are needed to determine the safest and most effective treatment modalities for the various types of posterior circulation stroke.

Keywords: CVA, PCS, Stroke

INTRODUCTION

Cerebrovascular accidents have been known since ancient times because of the characteristic clinical picture they produce. Hippocrates (470-370 B.C) described stroke as 'APOPLEXY' which means astonishment. Leoniceno described syphilitic hemiplegia in 1947. In 1911 Margurg first reviewed the topic of brain stem infarction and described clinical examples of basilar territory syndromes. In 1932 Pines and Gilinsky published detailed report that included serial section of brain stem in a patient with thrombosis of basilar artery. 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. The national Institute of Neurological Disorders and Stroke (NINDS) apply the term stroke to any one or all of a group of disorders including cerebral infarction, intra-cerebral haemorrhage or sub arachnoid haemorrhage.

Posterior circulation stroke (PCS) accounts for 20% of all strokes with high mortality and morbidity.[1] The area includes brain stem, cerebellum, occipital lobe and thalamus, and is supplied by vertebral arteries, the basilar

artery, and the 2 posterior cerebral arteries.[2,3] This is the only vascular region in the body where 2 arteries unite to form a large arterial trunk that again divides in 2 major branches. These arteries, through penetrating and short circumferential branches, supply the brain stem, thalamus, cerebellum, occipital, and medial temporal lobes.[4] Posterior circulation stroke can have diverse presentations that differ from strokes in anterior circulation in relation to aetiology, clinical features, and prognosis. Posterior circulation stroke can present with vertigo, ataxia, vomiting, headache, cranial nerve abnormalities, bilateral long tract neurological sign, "locked in" syndrome or impaired consciousness, and complex ocular signs or cortical blindness. The intracranial portion of posterior circulation is much more prone to atherosclerosis as compared to anterior circulation.

Stroke research and clinical trials have focused mainly on anterior circulation stroke (ACS). Since clinical characteristics, mechanisms, and outcomes of posterior circulation stroke (PCS) have been reported different from ACS, more PCS studies are required, particularly researching the aetiologies, to help establish an optimal management strategy. The aetiologies of PCS are heterogeneous and shown to be associated with functional outcomes. Large artery diseases, cardioembolism (CE), and small vessel diseases (SVDs) are most-acknowledged aetiologies of PCS. Besides arterial atherosclerotic stenosis/occlusion, there are two other kinds of large artery diseases, which are reported more frequently in PCS than in ACS. One is basilar artery (BA) atherosclerotic plaques with Para-median pontine infarction (atheromatous branch occlusive disease) and the other is arterial dissection. These two causes of PCS might be overlooked and less discussed since they need more extensive evaluation tools.

Following Kubic and Adams original study in 1946, a clinic-pathological study on total basilar arteries occlusion, PCS have traditionally been considered to have high morbidity and mortality.[1] Although few studies revealed low mortality rate among patients with vertebra-basilar territory infarcts.[5,6] However, with the publication of data from the New England Medical Centre – Posterior Circulation registry (NEMC-PCR), the risk factors and outcome in PCS have been better delineated.[7] We would need more studies solely on PCS elucidating particularly the causes and predictors of outcomes to help establish an appropriate management strategy for PCS. In the present study, PCS have been studied to determine clinical profile and prognosis in patients on admission, discharge and one-month follow-up.

METHODS

A prospective study was conducted over a period of 1 year in Seth G.S. Medical College and KEM Hospital. The study was carried out after obtaining permission from institutional ethics committee. Recently diagnosed cases of posterior circulation stroke from medicine and neurology wards, fulfilling inclusion criteria, were assessed. These patients were provided with patient information sheet and voluntary informed consent form. After explaining the nature of study and the advantage and disadvantage patients willing to participate and follow up were enrolled in the study. Demographic risk factors like age, gender, alcohol/tobacco abuse, diabetes, hypertension, ischemic and rheumatic heart disease, dyslipidemia and history of similar episodes in past were assessed. Patients were examined in detail. Patients with space occupying lesions and cortical sinus venous thrombosis were excluded.

Study procedure

Routine blood investigations complete haemogram, Renal function test, Liver function test, serum lipid profile, blood sugar, Neuroimaging- CT brain or MRI Brain was performed and entered in Proforma. Patient functional assessment using Functional Independence Measure Scale was done at time of admission, discharge and after one month.

Statistical analysis

Statistical analysis was done using ANOVA, paired T test.

RESULTS

The total number of patients included was 38 comprising of 21 male patients and 17 female patients. Peak incidence of posterior circulation stroke was between 41 to 71 years of age. Mean age of male was 56.52 years and female was 59.82 and median age in patients with posterior circulation stroke was 56.5 years. Gender distribution (Figure 1) in posterior circulation stroke showed male were 55% with female 45% with no statistically significant difference found in gender distribution (p=0.516).

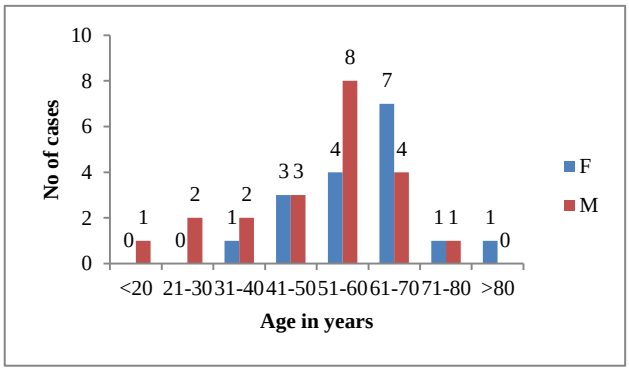

Figure 1: Age and gender wise distribution in posterior circulation stroke.

Ischemic stroke was seen in 24 (63.16%) patients and haemorrhagic stroke was seen in 14 (36.84%) patients.

The presenting symptoms of ischemic and haemorrhagic stroke in posterior circulation are as shown in Table 1. In ischemic stroke-most common risk factor was hypertension (66.66%) followed by diabetes (20.86%) tobacco addiction was present in 3 patients and 1 had cardiac disease (RHD).

In haemorrhagic stroke - most common risk factor was hypertension (50%) followed by diabetes (42.84%) tobacco addiction was seen in 2 patients and 1 had cardiac disease (IHD). There was no statistically significant difference (p>0.05) in various risk factors when compared between ischemic and haemorrhagic stroke.

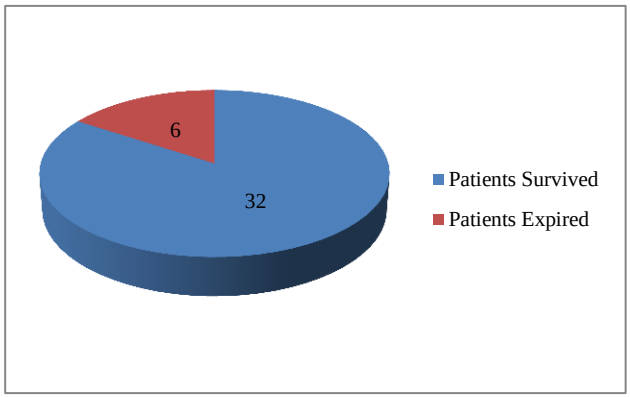

Figure 2: Mortality in posterior circulation stroke.

Most common site of infarct in posterior circulation stroke was cerebellum (37.5%) followed by occipital lobe (24%). Most common site of bleed in posterior circulation stroke was cerebellum (64.21%) followed by pons (35.79%). Mortality in posterior circulation stroke (Figure 2) was 15.78% in this study. Mortality in haemorrhagic stroke was higher (21.4%) than ischemic stroke (12.5%), however there was no statistically significant difference (p>0.46) in mortality of ischemic and haemorrhagic posterior circulation stroke. Results of Functional independence measures scale (FIM scale) is given in Table 2.

Table 1: Clinical presentation in ischemic stroke.

Clinical Presentation	In ischemic stroke (N=24%)	In haemorrhagic stroke (N=14%)
Ataxia	17 (70)	12 (85)
Vertigo	15 (62.6)	5 (35.71)
Headache	14 (58.33)	11 (78.57)
Vomiting	13 (54.16)	12 (85)
Speech disturbance	13 (54.16)	9 (64)
Motor disturbance	7 (29.16)	7 (50)
Visual disturbance	5 (20.83)	2 (14.22)
Sensory disturbance	4 (16.6)	-
Altered sensorium	4 (16.6)	8 (57.14)
Convulsion	2 (8.3)	-
Similar episode in past	1 (4.16)	-

Table 2: Functional independence measures scale (FIM scale).

Stroke	FIM score on admission				
	Mean	SD	Minimum	Maximum	N
Haemorrhagic	55.7	35.3	17	96	14
Ischemic	74.0	30.0	17	116	24
	FIM score on discharge				
Haemorrhagic	82.9	33.4	31	119	11
Ischemic	102.9	19.1	31	119	21

There was no statistically significant difference (p>0.13) in FIM score in patients of haemorrhagic and ischemic posterior circulation stroke on discharge. There was no statistically significant difference (p>0.06) in FIM score in patients of haemorrhagic and ischemic posterior circulation stroke at time of discharge, and follow-up after 1 month. However there was statistical significant difference in FIM score of patients who expired and survived. Table 3 is showing the outcome in PCS patients.

Table 3: Outcome.

Outcome	Mean	SD	Minimum	Maximum	N
Expired	17.0	0.0	17	17	6
Survived	76.7	26.5	17	116	32
Total	67.3	32.8	17	116	38

DISCUSSION

Posterior circulation strokes comprise 10-15% of all strokes, 80% of them being ischemic strokes. Most of the other studies have reported that 80% of strokes are ischemic and 20% of ischemic strokes involve the posterior circulation. The Lausanne Stroke Registry and the Besancon Stroke Registry revealed the relative prevalence of posterior circulation stroke to be 26.7% and 26%, respectively. Hallym Stroke Registry (HSR) showed that posterior circulation stroke was responsible for 39.8% of all ischemic strokes.

In present study, maximum patients were in the age group 41-70 years with mean age for males 56.52 years, and for females 59.82 years, with median age of 56.5 years. A study in a tertiary care hospital found the maximum number of patients in the age group of 40-55 years.[8] New England Medical Centre Posterior Circulation Registry (NEMC-PCR) demonstrated that majority of patients with posterior circulation stroke were in age group ranging between 66-75 years.[3] Stroke occurs in relatively younger people in developing countries. In present study only 3 patients (3.75%) were older than 75 years, while in NEMC-PCR 27.7% of patients were in age group ranging more than 75 years. Lower life expectancy in Indian population compared to the Western world (66.46 vs 78.24 years) could be the explanation for this difference. In this study, gender distribution showed that male were 55% whereas female were 45%, with no statistically significant difference (p=0.516). Published data from the Tufts New England Medical Centre posterior circulation stroke registry document showed that 58% of patients are male and 42% female.[3,4] When this study compared with older one, there is no statistically significant difference found between two studies (p=0.54).

In our study, 63.15% patients had ischemic stroke and 36.85% patients had haemorrhagic stroke. In a study by Uma Sundar, 77.6% patients had ischemic stroke and 22.4% patients had haemorrhagic stroke.[8] Most common clinical presentation in our study was ataxia (70%), followed by vertigo (62.6%). Study by Patrick et al found that most common clinical presentation was cranial nerve involvement was 64%, followed by altered sensorium (47%).[9] Kora et al study found most common presentation as motor disturbance and altered sensorium (63%) patients. In posterior circulation stroke is due to the involvement of cerebellum or its connections. Vertigo in posterior circulation stroke 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.[11] In posterior circulation stroke headache and vomiting are more frequently seen than in anterior circulation strokes.[10-13]

Fisher reported that headache in anterior circulation strokes is generally frontal, usually ipsilateral to the lesion, while posterior circulation stroke headache tended to be occipital.[14] A proposed explanation for this difference is that the cerebral vasculature of the meninges in the posterior circulation is more heavily innervated by nociceptive afferents than the anterior circulation. Vomiting may occur due to the involvement of vestibular nucleus or chemoreceptor trigger zone (CTZ). A study from China by Shi et al analysed clinical characteristics in 216 patients with posterior circulation stroke found dizziness in 33.8% and ataxia in 30%, which were less as compared to our observations. The above-mentioned study also demonstrated a relatively higher percentage of patients with motor weakness (81.9%) as compared to our study.

Most common risk factor for posterior circulation stroke in this study was hypertension (60.5%). Haematological investigation showed dyslipidaemia in 55.26% patients. Less common risk factors found in our study were diabetes (28%), tobacco abuse (13%), IHD (2.6%) and RHD (2.6%). This was comparable with study by Caplan et al where hypertension was risk factor in 61% patients.[15] Other risk factors found by them were tobacco abuse (35%), diabetes (25%) and dyslipidaemia (25%). Kora et al found most common risk factor for posterior circulation stroke as tobacco abuse 52% and hypertension as the second common risk factor (37%).

Table 4: Comparison of risk factors of various studies.

Risk factor	Ratnavali E et al[7]	Caplan et al[15]	Uma S et al[8]	Kora S A et al[17]	Present Study
Hypertension	23	61	35.5	37	60.5
Diabetes	20	25	21	5	28
Tobacco abuse	25	35	11.8	52	13
Ischaemic heart disease	5	-	17.1	5	2.6
Rheumatic heart disease	-	-	10.5	5	2.6
Dyslipidemia	-	25	44.4	10	55.26

Less common risk factors in this study were dyslipidaemia (10%), diabetes (5%), rheumatic heart disease (RHD) (5%) and Ischaemic heart disease IHD (5%). Study by Uma Sundar et al showed that dyslipidaemia as the most common risk factor (44.4%). Other risk factors found were hypertension (35.5%) and diabetes (21%). Ratnavali et al study showed tobacco abuse as the most common risk factor (25%) followed by hypertension (23%). Other risk factors found by them were diabetes (20%) and IHD (5%). Table 4 is showing Comparison of risk factors of various studies.

Most common site of involvement in present study for ischemic stroke in posterior circulation was cerebellum (37.5%) followed by occipital lobe (25%). Other sites of involvement were brain stem and pons, which were less commonly involved in present study. Most common site of bleed in posterior circulation / present study was cerebellum (64.4%) followed by pons (35.6%). The comparison between the site of involvement in current study and Kora et al study in ischemic stroke of posterior circulation is shown in Table 5.

Table 5: comparison between the sites of involvement in different studies.

Site of involvement Lobes	Kora et al[17]		Present study	
	Ischemic stroke %	Haemorrhagic stroke %	Ischemic stroke %	Haemorrhagic stroke %
Cerebellum	33.33	33.33	37.5	64.4
Occipital	26.66	16.66	25	-
Pons	6.6	50	12.5	35.6
Brain stem	6.6	-	12.5	-
Thalamus	6.6	-	4.2	-
Pons + occipital lobe	6.6	-	-	-
Cerebellum & occipital	6.6	-	8.3	-
Cerebellum, occipital &thalamus	6.6			

Mortality in posterior circulation stroke was 15.78% in present study. Uma et al study showed a mortality of 17%.[8] Patrick et al showed a mortality of 25.6%.[9] Jone et al study showed mortality of 27.5%.[16] Kora et al study showed mortality of 26.3%.[17] Vertebrobasilar disease has traditionally been considered a high morbidity and mortality state, consequent upon the original study by Kubik and Adams in 1946. Subsequent studies showed a uniformly high mortality rate (Hacke et al 70%, Mcdowell et al – 38%, Millikan et al – 30 %. [18-20] However, these studies examined the role of anti-coagulation or intra-arterial thrombolysis in angiography – proven vertebral or basilar occlusion and hence, by their very nature, included only the most severe cases of PCS. Bougusslavsky's study on unselected cases of PCS detected a mortality rate of 40%, whereas that of Hennessey, Pazdera et al (from the multi-centric PCS registry), found a mortality rate of 3.6% at 1 month with encouraging disability status (28% with no disability and 51% with minor disability on MRS), at 1 month post stroke.[8,12] There was 15.78% mortality rate in our study. Rest 84.22% patients showed improvement on follow-up after 1 month by functional independence measure. In Jone et al and Kora et al study, improvement was noted in 35% and 47.7% subjects respectively. Bougusslavsky's study on unselected cases of PCS detected a mortality rate of 40%, whereas that of Hennessey, Pazdera et al (from the multi-centric PCS registry), found a mortality rate of 3.6% at 1 month with encouraging disability status (28% with no disability and 51% with minor disability on MRS), at 1 month post stroke.[8]

CONCLUSION

This was an observational study done in a tertiary care hospital. Most common risk factor for posterior circulation stroke in our population was hypertension. The common site of involvement ischemic stroke in posterior circulation was cerebellum followed by occipital lobe. Optimal treatment and prevention for diseases need knowledge about diseases' aetiologies or mechanisms to be targeted at, unfortunately, stroke studies focused much more in ACS than PCS. There are very few studies on clinical profile and outcome in PCS we would need more studies solely on PCS elucidating particularly the causes and predictors of outcomes to help establish an appropriate management strategy for PCS.

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