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COMPARISON OF ETIOLOGY AND CLINICAL PROFILE OF ANTERIOR AND POSTERIOR CIRCULATION STROKE

Neurology

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ABSTRACT

BACKGROUND AND OBJECTIVES: Stroke is the second leading cause of death worldwide and the third commonest cause of mortality after heart disease and cancer in India. Clinicians have tended to view stroke occurring in the anterior circulation (AC) and the posterior circulation (PC) as separate entities because ischemic stroke occurs most commonly in the AC than PC. Episodes of PC stroke are often staggering and more protracted than those of AC stroke. Furthermore, AC and PC strokes have different underlying pathogenesis, natural histories, risk factors and complications. The present study was carried out with an objective to compare the etiology, clinical features and lab profile between the groups of anterior and posterior circulation strokes. **METHODS: STUDY POPULATION:** Patients presented to our institute with acute ischemic stroke either lying in anterior circulation or posterior circulation territories confirmed by MRI brain. STUDY DURATION: From 1st July 2023 to 30 june 2024. STUDY DESIGN: Cross-sectional, Prospective observational study. INCLUSION CRITERIA: (1) Patients aged above 18 years. (2) Patients presenting with acute ischemic stroke either lying in anterior circulation or posterior circulation territories confirmed by MRI brain. EXCLUSION CRITERIA: (1) Cerebral haemorrhage, space-occupying lesion, or trauma detected by the CT/ MRI Brain. (2) Transient Ischemic Attacks. (3) Patients lost to follow up at 1 month and 3 months after stroke onset. SAMPLE SIZE: 160 patients . The symptoms, neurological deficits, risk factors, blood parameters and other radiological imaging (MRI brain/ MR angiography/ carotid and vertebral artery DOPPLER and CT angiography/DSA when required) were assessed in each patient. **RESULTS:** In this study, out of a total number of 160 acute ischemic stroke patients, anterior circulation stroke was found to be the more common type comprising of 131 (81.87%) patients and the latter being posterior circulation stroke comprised of 29 (18.12%) patients. The mean age of the patients with ACS was 59.26 ± 16.47 years and in PCS was 59.1 ± 14.57 years. In our study, majority of the patients were aged above 50 years, with nearly two-thirds of the study cohort aged between 51-80 years. Maximum patients were in between 61-70 years, with ACS comprising 26.71%, PCS of 41.37%. Males were predominantly affected than females in our study with a male to female ratio of 1.75:1. Males were more in the PCS group as compared to ACS, but were comparable. Majority of patients presenting with PCS had milder GCS compared to ACS. But also, lesser but significant number of patients with severe GCS (3-8) had PCS compared to ACS and a significant number of patients with moderate GCS (9-12) had ACS. The mean baseline NIHSS score was higher in ACS compared to PCS. History of ischemic heart disease, presence of LA clot, and elevated serum creatinine (>1.4) were significantly associated with PCS. The most common cardiac abnormality 3 seen in our study was heart failure and the rest of the risk factors were comparable in both groups. In our study, limb weakness was the most common neurological deficit observed in both ACS and PCS groups, followed by dysarthria. Dysarthria was commonly seen in ACS, whereas headache, giddiness/vertigo, nausea/vomiting, Hemi-sensory deficits were commonly seen in PCS. **CONCLUSIONS:** In our study, majority of the patients were aged above 50 years, with nearly two-thirds of the study cohort aged between 51-80 years. Males were more in the PCS group as compared to ACS, but were comparable. Middle intracranial territory was the most commonly involved followed by distal and proximal intracranial territories in the PCS group. Lower GCS was common in PCS compared to ACS. History of ischemic heart disease, presence of LA clot, and elevated serum creatinine (>1.4) were significantly associated with PCS. Dysarthria was commonly seen in ACS, whereas headache, giddiness/vertigo, nausea/vomiting, hemi-sensory deficits were commonly seen in PCS.

KEYWORDS

Introduction:

Stroke is the second leading cause of death worldwide and third commonest cause of mortality after heart disease and cancer in India. Ischemic strokes constitute 80% of all strokes. TOAST categorises the strokes as those due to large artery disease, small artery disease, cardio embolism, or of undetermined origin. Ischemic strokes can also be classified by vascular territory, into those involving the Carotid system and those involving the vertebrobasilar system. Clinicians have tended to view strokes occurring in the anterior circulation (AC) and the posterior circulation (PC) as separate entities because the most common ischemic strokes occur in the AC, while strokes occurring in the PC are the most severe. Episodes are often staggering and more protracted than those of anterior circulation stroke. Furthermore, AC and PC strokes have different underlying pathogenesis, natural histories and potential responsiveness to interventions such as anticoagulation and risk factors.

Risk factors such as Hypertension, Diabetes and smoking have been found to have a higher prevalence in PCS as compared to ACS. The differences in vascular anatomy in the PCS, with the penetrating vessels branching off perpendicularly from the Basilar system, lead to different mechanisms of causation of arterial blockage. Further, involvement of brain stem vital centres in medullary strokes may be expected to lead to worse outcomes, as compared to ACS, and also in comparison to distal PCS. Up to one-third of stroke patients suffer from pneumonia. 1. Pneumonia causes the highest attributable mortality of all medical complications following stroke.2 Respiratory failure from stroke leads to intubation in up to 6% of patients suffering an ischemic stroke and 30% of patients with a hemorrhagic stroke.3 The present study attempts to compare the etiology of anterior and posterior circulation strokes.

MATERIALS AND METHODS

This study was done in patients presented with acute ischemic stroke either lying in anterior circulation or posterior circulation territories confirmed by MRI brain. The hospital based observational study in a total of 160 cases admitted as in patient from 1st July 2023 to 30 june 2024. This is designed as a cross-sectional, observational, prospective study, with each participant, being enrolled after taking due written informed consent, after fulfilling the inclusion and exclusion criteria. This study was approved by the ethical and scientific committee of hospital.

Inclusion criteria:

1) Patients aged above 18 years. 2) Patients presented with acute ischemic stroke either lying in anterior circulation or posterior circulation territories confirmed by MRI brain.

Exclusion criteria:

1) Patients with Cerebral hemorrhage, space occupying lesion or

trauma detected by the CT/ MRI Brain.

2) Transient Ischemic Attacks. 3) Patients lost to follow up at 1 month and 3 months after stroke onset.

RESULTS:

Table 1: Distribution of stroke subtype in ACS and PCS groups

STROKE SUBTYPE	N	PERCENTAGE
ANT CIRCULATION	131	81.87 %
POST CIRCULATION	29	18.12 %
TOTAL	160	100 %

In our study, out of 160 patients, anterior circulation stroke was found to be more common subtype comprising 81.87%, and the latter being posterior circulation stroke comprised of 18.12%.

TABLE 2-DISTRIBUTION 0F THE AGE IN ACS AND PCS GROUP

AGE GROUP	ACS	PCS	TOTAL
<20	1(0.76%)	0(0%)	1(0.625%)
21-30	9(6.87%)	1(3.44%)	10(6.25%)
31-40	10(7.63%)	4(13.79%)	14(8.75%)
41-50	15(11.45%)	2(6.89%)	17(10.62%)
51-60	29(22.13%)	5(17.24%)	34(21.25%)
61-70	35(26.71%)	12(41.37%)	47(29.37%)
71-80	20(15.26%)	4(13.79%)	24(15%)
81-90	10(7.63%)	1(3.44%)	11(6.87%)
>91	2(1.52%)	0(0%)	2(1.25%)
TOTAL	131	29	160

Out of 160 patients in our study group, majority of the patients were aged above 50 years, with nearly two-thirds of the study cohort aged between 51-80 years. Maximum number of patients affected was in between 61-70 years with ACS comprising 26.7% and PCS of 41.37%. The age distribution in both groups was nearly matched with no significance (p-value- 0.57, Chi-square value- 5.74). Mean age in ACS was 59.26 ± 16.47 and in PCS was 59.10 ± 14.57 years.

TABLE 3- GENDER DISTRIBUTION IN ACS AND PCS GROUPS

GENDER	ACS	PCS	TOTAL
MALE	81(61.83%)	21(72.41%)	102(63.75%)
FEMALE	50(38.16%)	8(27.58%)	58(36.25%)
TOTAL	131(100%)	29(100%)	160(100%)

In our study, males comprised of 63.75% and females are 36.25%. Of them posterior circulation strokes are more common in males(72.14%) and anterior circulation was more common in females(38.16%).

TABLE 4- COMPARISON OF PRESENTING COMPLAINTS IN ACS AND PCS GROUPS

PRESENTING COMPLAINTS	ACS	PCS	P VALUE
HEADACHE	30(22.90%)	14(48.27%)	0.004
NAUSEA/VOMITTING	13(9.92%)	10(34.44%	<0.001
CONVULSION	4(3.05%)	1(3.44%)	0.88
ALTERED SENSORIUM	69(52.67%)	11(37.93%)	0.47
APHASIA	52(39.69%)	9(31.03%)	0.22
LIMB WEAKNESS	121(92.36%)	23(79.31%)	0.064
DYSARTHRIA	109(83.20%)	16(55.17%)	0.001
GIDDINESS	5(3.8%)	6(20.68%)	0.009
SENSORY DEFICIT	30(22.90%)	19(65.51%)	<0.001

In our study, limb weakness was the most common presenting complaint in both ACS and PCS groups with 92.36% and 79.31% respectively, followed by dysarthria with 83.20% in ACS and 55.17% in PCS groups with statistical significance (p=0.01). Headache, giddiness, nausea/vomiting, hemisensory deficits were commonly seen in PCS compared with ACS, with statistical significance ($p < 0.05$). Whereas altered sensorium (ACS vs PCS – 52.67% vs 37.93%, p= 0.47), aphasia (39.69% vs 31.03%, p= 0.22) and least commonly convulsions (3.05% vs 3.44%, p= 0.88) were seen in both the groups

TABLE 5 -ASSOCIATION OF VARIOUS VASCULAR RISK FACTORS WITH ACS AND PCS

VASCULAR RISK FACTORS	ACS	PCS	P VALUE
DM-2	79(60.30%)	16(55.17%)	0.95
HTN	77(58.77%)	20(68.96%)	0.17
IHD	29922.13%)	11(37.93%)	0.04
PREVIOUS STROKE	15(11.45%)	4(13.79%)	0.43
SMOKING	32(24.42%)	9(31.03%)	0.4
ALCOHOL INTAKE	35(26.75%)	9(31.03%)	0.56
DYSLIPIDEMIA	49(37.40%)	14(48.27%)	0.37
VIT B12 DEFICIENCY	38(29.0%)	12(41.37%)	0.22
HYPERHOMOCYSTENEMIA	36(27.48%)	8(27.58%)	0.99
MALIGNANCY	1(0.76%)	1(3.44%)	0.57
APLA	0(0%)	0(0%)	0

In the present study, Ischemic heart disease was significantly associated with PCS (37.93%) than ACS (22.13%) with p value of 0.04. Hypertension was most commonly associated with PCS (68.96%) than ACS (58.77%) but had not attained statistical significance. Diabetes mellitus type 2 (ACS vs PCS – 60.30% vs 55.17%), malignancy (0.76% vs 3.44%, p = 0.57) and hyperhomocysteinemia (27.48% vs 27.58%, p = 0.99) were almost equally associated with both the groups. Previous stroke (11.45% vs 13.79%, p = 0.43), smoking (24.42% vs 31.03%, p = 0.4), alcoholism (26.71% vs 31.03%, p = 0.56), dyslipidemia (37.40% vs 48.27%, p = 0.37), vitamin B12 deficiency (29.00% vs 41.37%, p = 0.22) were slightly more associated with PCS but not of any statistical significance.

TABLE 6 –ASSOCIATION OF CARDIAC ABNORMALITIES WITH ACS AND PCS

CARDIAC ABNORMALITIES	ACS	PCS
RHD	11(8.39%)	2(6.89%)
INFECTIVE ENDOCARDITIS	0	0
HEART FAILURE	24(18.32%)	7(24.13%)
LA CLOT	1(0.76%)	1(3.44%)
AF	20(15.26%)	4(13.79%)
PFO	0	0

In the present study, the most common cardiac abnormality seen was heart failure and was slightly more associated with PCS but was statically insignificant (ACS vs PCS – 18.32% vs 24.13%). LA clot was significantly associated with PCS (0.76% vs 3.44%). Atrial fibrillation (15.26% vs 13.79%, p = 0.82) and RHD 8.39% vs 6.89%, p = 0.73) were slightly more common in ACS than PCS but were statistically insignificant.

TABLE 7 ASS0CIATION OF OTHER LAB PARAMETERS WITH ACS AND PCS

LAB INVESTIGATION		ACS	PCS
PLATELETS	THROMBOCYTOSIS	5(3.81%)	0
SERUM CREATININE	RENAL FAILURE(>1.4)	13(9.92%)	8(27.58%)
SERUM SODIUM	HYPONATREMIA(<135)	24(18.32%)	6(20.68%)
SERUM TSH	HYPERTHYROIDISM (<0.1) HYPOTHYROIDISM(>4.5)	9(6.87%) 12(9.16%)	2(6.89%) 2(6.89%)
LDL	>100	42(32.06%)	11(37.93%)
HDL	<30	21(16.03%)	4(13.79%)
HEMOGLOBIN	ANEMIA	19(14.50%)	2(6.89%)
	POLYCYTHEMIA	6(4.58%)	3(10.34%)

In the present study, renal failure (serum creatinine > 1.3) was significantly associated with PCS (9.92% vs 27.58%, p = 0.008). Anemia (14.50% vs 6.89%, p = 0.47) and 5 cases of thrombocytosis (3.81%, p = 0.52) were insignificantly more associated with ACS. Polycythemia, hyponatremia, thyroid abnormalities, elevated LDL and low HDL were almost equally associated with both ACS and PCS patients.

DISCUSSION

In this study, we have studied the main etiologies, clinical features and lab parameters of various types of anterior & posterior circulation strokes in a total of 160 acute ischemic stroke patients who met with the inclusion and exclusion criteria.

Various studies over the years have assessed the distribution of ACS & PCS in all strokes and accounted for approximately 80% and 20% respectively. In a study by Mehndiratta et al., of the total strokes, 81% of strokes were ischemic, and 10.45% of these were in a posterior circulation territory[4] In the present study, out of 160acute ischemic stroke patients, 131 (81.875%) of the patients had pure ACS and 29 (18.125%) had pure PCS.

In the present study, the mean age was 59.27 years ± 15.98 years, ranging from 19 to 92 years.

Sayyed JV et al. demonstrated that among the 1583 patients, the mean age was 59.1 (±14) years[5]The mean age of the patients with ACS had 59.26 ± 16.47 years and in PCS had 59.1 ± 14.57 years. In this study with 160 subjects, 102 (63.75%) were males and 58 (36.25%) were females. Males were predominantly affected than females in our study with male to female ratio of 1.75:1.

Representation of females in all stroke studies from the Indian subcontinent has been lesser than that for males. In a study by Dash et al.,[6]Stroke subtyping was conducted in accordance with the Trial of Org 10172 in Acute Stroke Treatment (TOAST) criteria. Of the 2,634 patients admitted for ischemic stroke, in their study the majority (83.4%) were male [6]Both in China and India, a strong preponderance of male stroke patients was found for the majority of age categories with a maximum proportion of male patients of 0.82 in the 35-44 years age group. In the present study, the representation of males in pure PCS was 21 out of 29 (72.41%) as compared to pure ACS being 81 out of 131 (61.83%). Males were more in the PCS group as compared to ACS, but were comparable in both the groups in the study.

Since the initial description of the clinical findings in a small group of select patients with brain stem infarction by Kubik and Adams [7,] disturbances of consciousness were considered to be an important feature of PCI. Archer et al. [8] reported 20 patients with basilar artery occlusion and found 19 of them had various impairments of consciousness. In the present study, most of the patients in both ACS and PCS groups, presented with mild GCS (13-15) i.e., 73.28% and 82.75% respectively. About 24.42% of ACS patients and 6.89% of PCS patients presented with moderate GCS, with statistical significance (p= 0.02). About 10.34% of PCS patients and 2.29% of ACS patients presented with severe GCS, with statistical significance (p= 0.05). Therefore majority number of patients presenting with PCS had higher GCS compared to ACS. Likewise in our study, a significant number of patients with low GCS (3-8) had PCS compared to ACS. The mean baseline NIHSS score was higher in ACS compared to PCS.
Vascular risk factors, namely hypertension, diabetes mellitus, ischemic heart disease, smoking, alcohol consumption, and others were assessed in this study. A total of 25.62% of our patients with stroke were smokers, out of which all were males. The abuse of tobacco both in the form of smoking & chewing was closely related with stroke. The social stigma of smoking prevents women from indulging in this activity. In this study 27.5% of patients had a history of alcoholism, all of them being men. Both of these risk factors were comparable in both ACS and PCS groups in the study.

In the present study, ischemic heart disease was significantly associated with PCS (37.93%) than ACS (22.13%). This association was not found in other studies in the literature and requires further studies to confirm or establish the true association. Hypertension was most commonly associated with PCS (68.96%) than ACS (58.77%) but has not attained statistical significance. Previous stroke, smoking, alcoholism, vitamin B12 deficiency, dyslipidemia were slightly more seen with PCS but not attained statistical significance. Diabetes mellitus type 2, malignancy, and hyperhomocysteinemia were comparable in both groups. This data cannot be taken as truly representative as the numbers were small and do not reflect the higher prevalence of stroke in our country.

Mousavi et al., have found that the prevalence of hypertension as a major risk factor of stroke and it was higher in patients with PC stroke in comparison to patients with AC stroke (60 % vs. 40.8%) and the odds ratio for PC stroke was 2.8 (95% CI; 1.27 ¨C 3.73)[9].Sayyed JV et al., demonstrated that there was no significant difference in the risk factor profile between ACS and PCS Sayyed JV et al., demonstrated rheumatic valvular disease was more in ACS.[5]

In the present study, nausea/vomiting, vertigo, and headaches were found to be the symptoms that occur more frequently in patients with PCI. Similar findings were also observed in the study by Tao et al[10]. Because circulation to the inner ear arises from the vertebrobasilar system, vertebral artery disease can cause vertigo that is usually accompanied by other brain stem or cerebellar symptomS .[11]

In the present study, renal failure (serum creatinine > 1.4) was significantly associated with PCS. Thrombocytosis was seen in ACS patients but not attained statistical significance. Polycythemia, anemia, hyponatremia, thyroid abnormalities, elevated LDL, and low HDL were all comparable in both groups.

A high serum creatinine concentration within the normal range is a marker for increased risk of cerebrovascular disease in both normotensive and hypertensive subjects. Stroke risk was significantly increased at levels above 116 micro mol/L (90th percentile) even after adjustment for a wide range of cardiovascular risk factors.Co-existence of several vascular risk factors in patients with CKD has been postulated as the reason for the observed association of renal dysfunction with stroke. The presence of proteinuria is itself an important risk factor for stroke even in the absence of reduced GFR and after the adjustment for other vascular risk factors. Even after studying extensive literature, no studies were 47 found comparing the association of elevated serum creatinine with anterior and posterior circulation strokes, which in our study was found to be significantly associated with PCS. This has been relatively understudied and requires further studies to look for further association.

In the present study, LA clot was similar in both PCS and ACS. The most common cardiac abnormality seen in our study was heart failure but was comparable in both ACS and PCS groups. Atrial fibrillation and RHD were comparable in both the groups.

In our study, RHD was present in 8.125% of all stroke patients with 8.39% in ACS and 6.89% in PCS groups. Sayyed JV et al., demonstrated rheumatic valvular disease was more in ACS[5]In the study by Uma et al., RHD was present in 10% of the PCS group[12]

In our study, limb weakness was the most common neurological deficit observed in both ACS and PCS groups, followed by dysarthria. Dysarthria was significantly associated with ACS compared to PCS patients. Headache, giddiness/vertigo, nausea/vomiting, sensory deficits were commonly seen in PCS in comparison with ACS with statistical significance, whereas altered sensorium, aphasia, and convulsions were comparable in both the groups.

In a series of articles from the New England Medical Center Posterior Circulation Registry, Caplan et. al., reported that unilateral limb weakness (38%) was the most frequent sign in the whole PCS cohort, hemiparesis and quadriparesis (62%) were the most common signs for patients with midbrain infarction, and hemiparesis was present in more than half of patients (50.6%), along with basilar artery occlusive disease.[13]

Behera BP et al., showed motor involvement (72.5%) was the commonest clinical feature among posterior circulation stroke followed by speech involvement (58.75%) and altered sensorium 46 (48.75%)[14] Zürcher E et al., demonstrated on multivariate analysis, those with PC AIS had lower National Institutes of Health Stroke Scale at admission, more often showed decreased consciousness, visual field defects, and vestibule-cerebellar signs, but fewer hemisyndromes, dysarthria, and cognitive symptoms compared to anterior circulation AIS patients.[15]

CONCLUSIONS:

In our study, majority of the patients were aged above 50 years, with nearly two-thirds of the study cohort aged between 51-80 years. Males were more in the PCS group as compared to ACS, but were comparable. History of ischemic heart disease, presence of LA clot, and elevated serum creatinine (>1.4) were significantly associated with PCS. Dysarthria was commonly seen in ACS, whereas headache, giddiness/vertigo, nausea/vomiting, hemi-sensory deficits were commonly seen in PCS.

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