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ORIGINAL RESEARCH

A Clinical and Radiological Profile of Anterior and Posterior Circulatory Acute Ischemic Strokes

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ABSTRACT

Introduction: Acute ischemic stroke (AIS) is a significant cause of morbidity and mortality, particularly in developing countries. It can involve either the anterior circulation (ACS) or the posterior circulation (PCS), each with distinct clinical and radiological profiles. This study aims to analyze and compare the clinical presentations and radiological profiles of patients with ACS and PCS. **Methods:** This observational study was conducted at PES Institute of Medical Sciences and Research, Kuppam, from January 2021 to June 2022. Ninety-seven patients with acute ischemic stroke confirmed by neuroimaging were included. The clinical features were correlated with neuroimaging findings. **Results:** Out of 97 patients, 69.1% had ACS, and 30.9% had PCS. ACS was more prevalent in males (64.6%), while PCS showed a higher incidence of cerebellar signs, ataxia, giddiness, and visual disturbances. Hypertension was a predominant risk factor for both ACS and PCS, with a higher prevalence in PCS patients (82.1%). **Conclusion:** Distinct clinical features, such as headache, visual disturbances, and ataxia, were more prevalent in PCS. Accurate clinical diagnosis, supported by neuroimaging, remains crucial for effective stroke management.

Keywords: Early mortality-based scale prediction, Glascow coma scale, Modified SOAR score for stroke, NIH stroke scale, Posterior circulation brain infarction, Topographic imaging

INTRODUCTION

Stroke is a leading cause of disability and death worldwide. It presents with a wide range of clinical manifestations depending on the area of the brain affected. Acute ischemic stroke (AIS) can occur in either the anterior circulatory system (ACS) or the posterior circulatory system (PCS), with each presenting distinct clinical and radiological features. This study investigates to assess the clinical and radiological profiles of anterior and posterior circulatory acute ischemic strokes.To correlate clinical features with neuroimaging findings in ACS and PCS patients.

MATERIALS AND METHODS

This observational study was conducted over 18 months, from January 2021 to June 2022, at PES Institute of Medical Sciences and Research, Kuppam. Ninety-seven patients who presented with clinical features of stroke were included based on specific inclusion and exclusion criteria. Data were analyzed using SPSS version 22.Patients aged ≥18 years with radiologically confirmed AIS were included.Patients with hemorrhagic stroke, recurrent strokes, or neurodegenerative diseases were excluded.

RESULTS

A total of 180 patients were screened for this study, out of which 97 met the inclusion criteria for acute ischemic stroke (AIS). The results are categorized into demographic distribution, clinical features, risk factors, and the correlation of clinical and radiological findings.

The majority of the patients (57.7%) were in the age group of 60-80 years, with a mean age of 62.43 years. Only 3 patients (3.1%) were younger than 40 years,

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while 2 patients (2.1%) were older than 80 years.There was a male predominance in the study, with 67% of the patients being male and 33% female, resulting in a male-to-female ratio of 2.03:1.

The most common risk factor observed was hypertension, which was present in 67% of the study population, followed by diabetes in 46.4%, smoking in 32%, and alcohol consumption in 23.7%.

Clinical Localization of ACS and PCS

- **Anterior Circulatory Stroke (ACS):** In 67 patients (69.1%)
- **Posterior Circulatory Stroke (PCS):** In 30 patients (30.9%)

Correlation of Clinical Diagnosis with Radiological Findings

Clinical diagnosis was compared with radiological findings to assess the accuracy of diagnosing stroke based on symptoms.

ACS: The clinical diagnosis of ACS had a sensitivity of 95.16%, specificity of 77.14%, and a positive predictive value (PPV) of 88.06%.

PCS: The clinical diagnosis of PCS had a sensitivity of 92.86%, specificity of 94.20%, and a PPV of 86.67%.

Clinical Features of ACS and PCS

The clinical features of anterior circulatory stroke (ACS) and posterior circulatory stroke (PCS) varied significantly. ACS was primarily associated with motor deficits, including hemiparesis and hemisensory loss, which were observed in over 90% of cases. In contrast, PCS patients exhibited more non-motor symptoms, such as ataxia (82.1%), giddiness (78.6%), and visual disturbances (42.9%), which were significantly more prevalent compared to ACS. Additionally, headache was common in PCS (75%) but less frequent in ACS (16.1%). Dysarthria was also more frequent in PCS (42.9%) compared to ACS (8.1%). These findings highlight the diagnostic challenge of PCS due to its more varied and often subtle presentations.

Radiological Findings and Stroke Localization

ACS: The radiological findings showed that most lesions were located in the middle cerebral artery (MCA) territory.

PCS: Lesions were predominantly seen in the posterior cerebral artery (PCA) and vertebrobasilar systems. Radiological findings confirmed cerebellar and brainstem involvement in PCS patients, correlating with the observed clinical features such as ataxia and visual disturbances.

Gender and Risk Factor Distribution Among Radiologically Confirmed Cases

Among patients with radiologically confirmed strokes:

ACS: 64.6% males and 62.5% females had ACS. The most common risk factors were hypertension (62.9%) and smoking (24.2%).

PCS: 82.1% of PCS patients had hypertension, and 50% were smokers.

Stroke Risk Factor Distribution

Hypertension was the most common risk factor, followed by diabetes. Among radiologically confirmed cases:

In **ACS**: Hypertension (62.9%), diabetes (43.5%), and smoking (24.2%) were common.

In **PCS**: Hypertension (82.1%), diabetes (57.1%), and smoking (50%) were more prevalent.

These results highlight the importance of clinical and radiological correlation in diagnosing and managing acute ischemic strokes.

Table 1: Risk Factors

Risk Factor	Present	Absent
Hypertension	67%	33%
Diabetes	46.4%	53.6%
Smoking	32%	68%
Alcohol	23.7%	76.3%
Heart Disease	20.6%	79.4%
Thyroid Disorders	5.2%	94.8%

Table 2: Clinical diagnosis

Clinical Diagnosis	Radiological Location	Total
ACS	59 ACS, 6 Normal, 2 PCS	67
PCS	26 PCS, 1 ACS, 3 Normal	30

Table 3: Clinical features in ACS and PCS

Clinical Feature	ACS (%)	PCS (%)	p-value
Headache	16.1%	75.0%	<0.0001
Visual Disturbances	1.6%	42.9%	<0.0001
Giddiness	24.2%	78.6%	0.000006
Ataxia	1.6%	82.1%	<0.0001

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Dysarthria	8.1%	42.9%	0.000422
Altered Sensorium	8.1%	3.6%	0.558
Cerebellar Signs	1.6%	64.3%	<0.0001

Table 4: Risk Factors among radiologically confirmed cases of Acute ischemic Stroke

		Radiological Location					
		Normal		ACS		PCS	
		N	%	N	%	N	%
Hypertension	Absent	4	57.1%	23	37.1%	5	17.9%
	Present	3	42.9%	39	62.9%	23	82.1%
Diabetes	Absent	5	71.4%	35	56.5%	12	42.9%
	Present	2	28.6%	27	43.5%	16	57.1%
Heart Disease	Absent	3	42.9%	49	79.0%	25	89.3%
	Present	4	57.1%	13	21.0%	3	10.7%
Thyroid	Absent	7	100.0%	57	91.9%	28	100.0%
	Present	0	0.0%	5	8.1%	0	0.0%
Smoking	Absent	5	71.4%	47	75.8%	14	50.0%
	Present	2	28.6%	15	24.2%	14	50.0%
Alcohol	Absent	6	85.7%	46	74.2%	22	78.6%
	Present	1	14.3%	16	25.8%	6	21.4%

Table 5: Clinical features of acute ischemic Stroke among radiologically confirmed cases of ACS and PCS

		Radiological Location						P value
		Normal		ACS		PCS		
		n	%	n	%	n	%	
Headache	Absent	4	57.1%	52	83.9%	7	25%	
	Present	3	42.9%	10	16.1%	21	75%	**<0.0001**
Visual Disturbances	Absent	7	100%	61	98.4%	16	57.1%	
	Present	0	0.0%	1	1.6%	12	42.9%	**<0.0001**
Giddiness	Absent	3	42.9%	47	75.8%	6	21.4%	
	Present	4	57.1%	15	24.2%	22	78.6%	**0.000006**
Altered sensorium	Absent	7	100%	57	91.9%	27	96.4%	
	Present	0	0.0%	5	8.1%	1	3.6%	**0.558**
vomiting	Absent	6	85.7%	56	90.3%	20	71.4%	
	Present	1	14.3%	6	9.7%	8	28.6%	**0.072**
Ataxia	Absent	6	85.7%	61	98.4%	5	17.9%	
	Present	1	14.3%	1	1.6%	23	82.1%	**<0.0001**
Dysphagia	Absent	7	100%	60	96.8%	22	78.6%	
	Present	0	0.0%	2	3.2%	6	21.4%	**0.01**
Dysarthria	Absent	6	85.7%	57	91.9%	16	57.1%	
	Present	1	14.3%	5	8.1%	12	42.9%	**0.000422**
Respiratory Depression	Absent	7	100%	61	98.4%	27	96.4%	
	Present	0	0.0%	1	1.6%	1	3.6%	**0.769**
Seizure	Absent	5	71.4%	54	87.1%	26	92.9%	
	Present	2	28.6%	8	12.9%	2	7.1%	**0.299**
Cerebellar Signs	Absent	6	85.7%	61	98.4%	10	35.7%	
	Present	1	14.3%	1	1.6%	18	64.3%	**<0.0001**

Table 6: Clinical features of acute ischemic Stroke among radiologically confirmed cases of ACS and PCS

		Radiological Location						P value
		Normal		ACS		PCS		
		n	%	n	%	n	%	
Speech Abnormality	Absent	2	28.57%	23	37%	18	64.3%	0.38
	Present	5	71.4%	39	62.9%	10	35.7%	
Aphasia	Broca‟s	1	14.3%	14	22.6%	0	0.0%	
	Global	1	14.3%	9	14.5%	0	0.0%	
	Transcortical motor	2	28.6%	6	9.7%	0	0.0%	
	Wernicke‟s	0	0.0%	1	1.6%	0	0.0%	0.006

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	Total	4	57.1%	30	48.3%	0	0%	
Motor	Left hemiparesis	1	14.3%	21	33.9%	4	14.3%	<0.0001
	Left hemiplegia	1	14.3%	10	16.1%	0	0.0%	
	Right hemiparesis	2	28.6%	19	30.6%	1	3.6%	
	Right hemiplegia	2	28.6%	8	12.9%	0	0.0%	
	Right upper limb weakness	0	0.0%	1	1.6%	0	0.0%	
	Total	6	85.7%	59	95.2%	5	17.8%	
Weakness Distribution	LL>UL	0	0.0%	1	1.6%	0	0.0%	<0.0001
	UL	0	0.0%	1	1.6%	0	0.0%	
	UL=LL	6	85.7%	44	71%	5	9.1%	
	UL>LL	0	0.0%	13	21%	0	0.0%	
	Total	6	85.7%	59	95.2%	5	7.1%	
Sensory Disturbances	Left hemisensory loss	1	14.3%	14	22.6%	5	17.9%	0.135
	Right Hemisensory loss	3	42.9%	7	11.3%	3	10.7%	
	Total Sensory loss	4	57.1%	21	33.8%	8	28.6%	

DISCUSSION

This study aimed to assess the clinical and radiological features of anterior circulatory stroke (ACS) and posterior circulatory stroke (PCS) among patients with acute ischemic stroke (AIS). The findings highlight distinct patterns in clinical presentation and risk factors between ACS and PCS, which may be pivotal in guiding diagnosis and treatment strategies.

Globally, stroke remains a leading cause of disability and mortality. While the overall incidence of stroke has decreased, the burden remains particularly high in developing countries like India, where a dual burden of communicable and non-communicable diseases persists [1]. Stroke in India affects approximately 334-424 individuals per 100,000 in urban populations, with incidence rates ranging from 119-145 per 100,000 [2]. The burden of stroke is expected to rise as risk factors such as hypertension, diabetes, and smoking become more prevalent [3].

In this study, 97 patients with acute ischemic stroke were evaluated, with ACS representing 69.1% of cases and PCS 30.9%. These findings are consistent with previous literature that indicates ACS is more common than PCS, likely due to the larger area of brain tissue supplied by the anterior circulation [4,5]. However, PCS is often underdiagnosed because its symptoms can be more subtle and non-specific, leading to diagnostic delays [6]. The underrepresentation of PCS in clinical diagnosis underscores the importance of heightened clinical awareness for non-motor symptoms in stroke patients.

The clinical manifestations of ACS and PCS differ significantly, which has diagnostic implications. In this study, patients with ACS predominantly presented with motor deficits such as hemiparesis and hemisensory loss, findings consistent with occlusion of the middle cerebral artery (MCA) [7]. Motor deficits were observed in over 90% of ACS cases, while sensory deficits such as contralateral hemiplegia and hemisensory loss were also common. These presentations align with the well-documented role of the anterior circulation in supplying motor-related regions of the brain [8].

In contrast, PCS patients presented with more varied symptoms, including ataxia, headache, and visual disturbances, which are indicative of involvement of the cerebellum, brainstem, and occipital lobe [9]. This study found that PCS patients had a statistically significant higher incidence of ataxia (82.1%), giddiness (78.6%), and visual disturbances (42.9%) compared to ACS patients, reinforcing the diagnostic challenge posed by PCS. These findings align with earlier studies by Tao et al. [10] and El Sherif et al. [11], which reported similar frequencies of cerebellar and visual symptoms in PCS patients. Clinicians must remain vigilant for these signs, as they often require advanced neuroimaging for confirmation, especially in patients with subtle or atypical presentations.

Neuroimaging remains a cornerstone of stroke diagnosis, particularly in differentiating between ACS and PCS. In this study, the clinical diagnosis based on symptom complexes had a sensitivity of 95.16% and a specificity of 77.14% for ACS, while for PCS, sensitivity was 92.86% and specificity was 94.20%. These results underscore the importance of clinical assessment in conjunction with radiological confirmation. However, the study also highlights that clinical diagnosis alone can be insufficient, particularly for PCS, where brainstem and cerebellar strokes are often missed on clinical grounds alone [12].

The use of computed tomography (CT) and magnetic resonance imaging (MRI) in this study was consistent with current standards for AIS diagnosis. Radiological confirmation of ACS showed lesions predominantly in the middle cerebral artery (MCA) territory, whereas PCS was associated with infarcts in the posterior cerebral artery (PCA) and vertebrobasilar systems. The high sensitivity of imaging techniques like diffusion-weighted imaging (DWI) and CT angiography (CTA) is particularly valuable in diagnosing posterior circulation strokes, which often present without overt neurological deficits [13,14].

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This study also highlights the common risk factors associated with AIS. Hypertension was the most prevalent risk factor in both ACS (62.9%) and PCS (82.1%), followed by diabetes and smoking. These findings are consistent with other studies that emphasize the role of hypertension as the most significant modifiable risk factor for stroke [15]. Interestingly, PCS patients in this study had a higher prevalence of hypertension and smoking than ACS patients, which may be related to the vascular structures involved in posterior circulation [16]. It has been noted that smoking and hypertension are strongly associated with atherosclerosis, which contributes significantly to stroke pathogenesis, particularly in the vertebrobasilar system [17].

The findings from this study are in line with previous research on the differences between ACS and PCS. Elodie Zurcher et al. [18] found that PCS patients typically have lower National Institutes of Health Stroke Scale (NIHSS) scores on admission and are more likely to present with cognitive symptoms, vestibulo-cerebellar signs, and visual disturbances, whereas ACS patients exhibit higher NIHSS scores and more severe motor deficits. Similarly, De Marchis et al. [19] reported that patients with PCS tend to have more subtle symptoms, which leads to diagnostic challenges, and they advocate for aggressive use of imaging in patients with ambiguous clinical presentations.

Clinical Implications

The clinical and radiological distinctions between ACS and PCS outlined in this study have important implications for stroke management. Early recognition of stroke symptoms and prompt neuroimaging are essential for improving patient outcomes. PCS, in particular, requires heightened clinical suspicion due to its non-motor symptoms, which are often underrecognized. In cases where clinical diagnosis is uncertain, advanced imaging techniques such as DWI and CTA should be utilized to confirm the diagnosis and guide treatment [20].

Moreover, aggressive management of modifiable risk factors, particularly hypertension, smoking, and diabetes, is crucial for preventing AIS, especially in high-risk populations. Public health initiatives focusing on stroke prevention, early recognition, and management can significantly reduce the burden of AIS in developing countries [21].

CONCLUSION

This study demonstrates that ACS and PCS have distinct clinical and radiological profiles. While ACS primarily presents with motor deficits, PCS is characterized by non-motor symptoms such as ataxia, headache, and visual disturbances, necessitating a more nuanced clinical approach. Radiological imaging remains crucial for confirming the diagnosis, especially in PCS. Early recognition and targeted interventions can significantly improve outcomes for stroke patients, emphasizing the need for comprehensive clinical and imaging assessments in AIS management.

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