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A CROSS-SECTIONAL STUDY OF RECOVERY PATTERN IN WATERSHED INFARCTS IN A TERTIARY CARE CENTRE.

Neurology

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ABSTRACT

Background: Acute ischaemic stroke is one of the leading causes of morbidity along with cancers and cardiovascular diseases. Millions suffer from acute ischaemic stroke every year worldwide of which 5% suffer from watershed infarcts(1). The aetiopathogenesis and recovery from deficits in watershed infarcts are different from territorial infarcts. The identification of specific features of recovery pattern and pathogenesis of infarcts may throw more light on these diseases as modern-day treatment of stroke is mainly concentrated on the treatment of territorial infarcts like endovascular procedures. This study may help to fill that gap. **Aim:** To study the recovery pattern in acute watershed infarcts. **Methodology:** 153 patients with acute watershed infarcts were studied. Detailed examination, NIHSS Score,mRS scale and Barthel index were assessed at the presentation and after 90 days of follow-up. Patients with Cognitive impairments were assessed and followed up after 90 days. Statistical analyses were done using SPSS 25.0 software for Windows. Chi-square and independent t-tests were applied to analyze categorical and numerical data, respectively. **Results:** A total of 153 patients out of the 2233 acute strokes were studied. The mean NIHSS score,mRS scale, and Barthel Index in patients of watershed infarcts are 10.9,3.1,62.9, and after 90 days are 7.9,2.3, and 74.5 respectively. The comparison was statistically significant. Most patients had significant motor improvement and cognitive improvement. The most common etiology was Internal Carotid artery thrombosis which also had the best prognosis. **Conclusion:** The pathogenesis and recovery in Watershed Infarcts are different from that of territorial infarcts. Prognosis and Recovery depend upon the etiology. Both Motor and Cognition recovery in watershed infarcts is significantly higher.

KEYWORDS

NIHSS,mRS, Barthel Index, Cognition, Watershed Infacrts

INTRODUCTION

Acute Ischemic Stroke is one of the leading causes of morbidity along with cancers and cardiovascular diseases. Millions suffer from acute ischaemic stroke every year worldwide of which 5% suffer from watershed infarcts(1). Watershed infarcts, also known as border zone infarcts, are a type of stroke that occurs in areas of the brain supplied by small blood vessels at the border between two larger arteries. These areas are particularly vulnerable to ischemic injury because they receive less blood flow and oxygen than other parts of the brain. They typically result from a sudden decrease in blood flow to the brain, which can be caused by a variety of factors such as blood clots, blockages, or narrowing of blood vessels. The symptoms of watershed infarcts can vary depending on the location and severity of the stroke but may include Hemiplegia or hemiparesis, aphasia, dysarthria, and cognitive Dysfunction.

The Aetiopathogenesis and recovery from deficits in watershed infarcts are different from territorial infarcts. The studies done on the recovery pattern of these infarcts are fewer. The Identification of Specific Features of recovery pattern and pathogenesis of infarcts may throw more light on these diseases as modern-day treatment of stroke is mainly concentrated on the treatment of territorial infarcts like endovascular procedures. This Study may help to fill that gap. (2,3,4,5) Recovery from watershed infarcts can vary widely depending on the location and severity of the stroke, as well as individual factors such as age, overall health, and the presence of other medical conditions. In general, recovery from a watershed infarct can be slow and may require ongoing rehabilitation to help individuals regain function and independence.

Rehabilitation for watershed infarcts may include physical therapy, occupational therapy, and speech therapy, depending on the specific deficits caused by the stroke. They can help individuals regain strength, balance, and coordination, while occupational therapy can help improve everyday activities such as dressing, grooming, and eating. Speech therapy can be helpful for those who experience aphasia and dysarthria.(6,7,8,9,10,11,12)

It is important to note that recovery from a watershed infarct can be long, and some individuals may not fully regain all lost functions. However, with appropriate medical care and rehabilitation, many people can make significant improvements in their quality of life and ability to perform daily activities.

Treatment for watershed infarcts typically involves managing the underlying cause of the stroke, such as blood pressure control or anticoagulation therapy to prevent blood clots. Rehabilitation may also be necessary to help individuals recover from any physical or cognitive deficits caused by the stroke.(6,7,8)

MATERIALAND METHODS

Study Population: All Patients with acute watershed infarcts attending the neurology department
Study Design: Cross-sectional observational study
Sample Size: All Patients with acute water shed infarcts admitted between August 2021 to December 2022

All patients admitted with acute watershed infarcts are taken for study. The diagnosis is done with the help of MRI Brain studies. All patients gave informed consent for their participation in this study. The study was approved by the Medical Ethics Committee of Tirunelveli medical college.

All patients undergo basic blood investigations, complete general and neurological examination, ECG, echocardiogram, and carotid and vertebral artery Doppler studies.

Stroke severity is assessed by the NIHSS scale,mRS scale, and Barthel Index at the time of admission and 90 days after admission.

NIHSS stands for the National Institutes of Health Stroke Scale, which is a standardized tool used to assess and measure the severity of stroke symptoms in patients. The NIHSS score ranges from 0 to 42, with higher scores indicating more severe stroke symptoms.

The Barthel Index is frequently used by healthcare professionals to assess the functional status of patients and to track changes in their ability to carry out ADLs over time. The index is composed of 10 items that represent various activities of daily living, such as grooming, bathing, dressing, feeding, and toileting. Each item is scored on a scale of 0-100, with a total score of 100 indicating complete independence in all activities and a score of 0 indicating complete dependence on others for all activities.

The mRS scale, or modified Rankin Scale, is a widely used tool to measure the degree of disability or dependence after a stroke or other neurological conditions. It ranges from 0 to 6, with higher scores indicating a more severe disability.

Higher Mental Functions and lobar functions are assessed in detail in all of them in standard proforma followed by the department and patients having cognitive dysfunction are compared against the ones

with normal cognitive function.

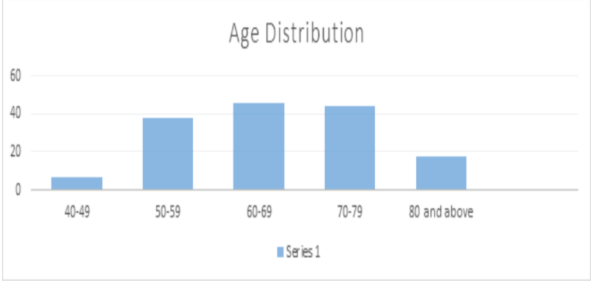
Statistical Analysis

It was performed using the statistical package for social sciences (SPSS), version 27. The mean, standard deviation, median, and ranges were calculated for continuous variables whereas proportion and frequency tables were used to summarize categorical variables. The Chi-square test was used to test for the significance of the association between the independent (predictor) and dependent(outcome) variables in categorical variables. P value <0.05 was considered significant.

RESULTS

A total of 2232 cases of acute ischemic stroke were admitted to our department during the entire course of our study. Among them, 153 cases had watershed infarct and were involved in our study. The mean age was 66. There were 86 Males and 67 Females. Among the cases 55 cases had anterior watershed infarcts, 91 cases had posterior watershed infarcts and 7 patients had subcortical infarcts. Etiologies for the infarcts were embolic(21%), Internal carotid thrombosis(63%), hypotension(29%), and Heart failure(28%).56 patients had right-sided infarcts and 88 patients had left-sided infarcts and 9% had bilateral infarcts.

Basic characteristics	N	Percentage
Age mean, median, SD	66 ±10.67	
Age group		
40-49 years	7	4
50-59 years	38	25
60-69 years	46	30
70-79 years	44	29
80 and above	18	12
Sex		
Males	86	56
Females	67	44
Anterior	55	77.8
Posterior	91	22.2
Subcortical	7	
IC thrombosis	63	41
Emboli	33	22
Heart Failure	28	18
Hypotension	29	19



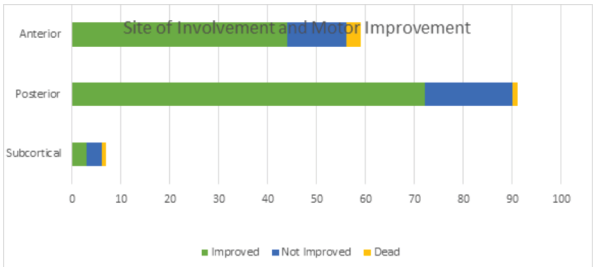
Measuring the NIHSS scale,mRS scale and Barthel Index at baseline and 90days are as follows and its statistical analysis using paired student t-tests is as

	Baseline			At 90days			Statistical Significance
	Mean	Median	SD	Mean	Median	SD	
NIHSS	10.9	11	3.4	7.9	7	3.7	0.00
mRS	3.1	3	0.52	2.3	2	0.98	0.00
Barthel Index	62.9	65	10.5	74.5	80	17.3	0.00

Among the 153 patients,117 patients had significant motor improvement,31 patients had less or no improvement and 5 patients died.

Among 153 patients,54 patients had impaired cognition and after 90 days 31 patients had improvement in cognitive functions and 18 patients had no improvement and 5 patients died before follow-up. Among 54 patients, higher mental function assessment showed 34 patients have temporal lobe involvement and 13 patients had frontal lobe dysfunction and 5 patients had parietal lobe dysfunction.

	Baseline(Total Patients)	Improved
Motor Involvement	153	117
Cognition Involvement	54	31



	Motor Improvement and Etiological				Chi-Square Test (P value)
	Etiology	Improved	Not Improved	Died	
1	Internal Carotid Thrombosis	59	3	1	0.000
2	Embolic	28	5	0	
3	Heart failure	15	11	2	
4	Hypotension	15	12	2	

	Motor Improvement and Etiological				Chi-Square Test (P value)
	Etiology	Improved	Not Improved	Died	
1	Anterior	43	11	1	0.206
2	Posterior	71	17	3	
3	Subcortical	3	3	1	

DISCUSSION

Watershed Infarcts are usually due to hemodynamic compromise. The etiology, clinical presentation, prognosis, and recovery pattern are different from the territorial infarcts. Patients usually have better and quick recovery in watershed infarcts and the recovery depends upon the etiology and location of the infarcts. The number of studies done on the recovery of watershed infarcts is very limited.

A total of 2232 stroke patients were screened and 153 among them had watershed infarcts and which make up 6.8% of all stroke cases. Posterior watershed infarcts were higher in number compared to anterior watershed infarcts and very few subcortical infarcts. Both Anterior and Posterior water shed infarcts had significant improvement without one being better than the other. There was no relation observed between the site of infarction and prognosis in our study.

In this study, recovery was assessed with NIHSS score, mRS scale, and Barthel index at the presentation of 153 stroke patients with watershed infarcts, and after 90 days showed significant improvement and the difference was statistically significant. 76% of the patients improved among the watershed infarcts. Patients with watershed infarcts have good recovery compared to territorial infarcts.

Internal carotid artery thrombosis was the most common cause followed by embolic, heart failure, and hypotension. Patients with Internal carotid artery thrombosis and embolic causes had better improvement compared to heart failure and hypotension.

A total of 54 patients among 153 had cognitive impairment. 31 patients had significant improvement in their cognition after 90 days. Most patients had motor and sensory aphasias and memory impairments. A few had impaired attention, executive dysfunction, and visuospatial deficits. The most commonly affected lobe was the temporal followed by the Frontal.

CONCLUSION

The pathogenesis and recovery pattern of watershed infarcts is different from that of territorial infarcts. The Recovery pattern of watershed infarcts is better than that of territorial infarcts and most patients may show complete recovery. Recovery varies with the pathogenesis. (1) Patients with Internal Carotid Artery thrombosis and Embolic causes have better prognoses among watershed-shed infarcts. So these patients could be intervened early to avoid recurrent episodes and adequately managed to expect a better outcome. Similarly, patients with hypotension and heart failure managed more aggressively to avoid watershed strokes. The option for better improvement may be more helpful for the treating physicians to formulate the correct treatment

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