



## MULTIFOCAL ISCHEMIC STROKE WITH ACALCULIA, MODERATE DEMENTIA, AND ABSENCE OF EXPECTED SYMPTOMS

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### ABSTRACT

*A significant number of individuals worldwide are affected by multifocal ischemic stroke each year. Surprisingly, a considerable portion of these cases show minimal neurological impairments. The cognitive symptom known as acalculia, characterized by the inability to perform basic mathematical tasks. Absence of limb power combined with cognitive problems such as acalculia may indicate that the stroke has specifically impacted regions of the brain that play a greater role in cognitive processing rather than motor abilities. This case report details the medical presentation of a previously healthy and athletic 73-year-old male with a history of alcohol consumption and smoking, presenting with atrial fibrillation and acute ischemic cerebrovascular accident with moderate to mild dementia. Radiological presentation characterized by unusual multifocal cerebral involvement, contrasted with surprisingly minimal neurological deficits.*

### Introduction

Ischemic stroke, a leading cause of severe disability, typically presents with focal neurological deficits correlating to a specific vascular territory. However, multifocal ischemic strokes involving several distinct vascular territories simultaneously represent a unique diagnostic and clinical challenge [1]. After 2019, multifocal strokes during the COVID-19 pandemic became a significant complication of coronavirus disease. Diagnosing these strokes was often linked to specific risk factors such as atrial fibrillation or other causes of embolism [2].

The relationship between changes in alcohol consumption and the risk of stroke was explored in AHA journals, presenting that a decrease in alcohol consumption from a high to moderate level was found to be linked with a 17% reduction in the risk of ischemic stroke after three examinations [3].



The cognitive deficits in stroke patients, including memory, orientation, language, and attention impairments, were carefully evaluated and found to be linked to a higher dependency on post-stroke living conditions. The results from the study of acute infarct locations and their correlation with cognitive impairments examined that cognitive impairments on the MMSE were significantly associated with lesions in specific areas of the brain, such as the left middle cerebral artery (MCA) territory and thalamus [4,5].

### Case presentation

*Consent has been obtained from the patient for the use and publication of personal information related to this research. The patient was fully informed about the purpose, potential benefits and risks of the study, as well as how their personal data will be used and protected. To ensure confidentiality and comply with data protection regulations, all personal data concerning the patient has been anonymized.*

A 72-year-old male with a 42-year history of smoking at least ten cigarettes per day (equivalent to half a pack) and daily alcohol consumption presented with complaints of dizziness and a recent fall during a shower, resulting in disorientation. He has a history of hypertension and takes medications accordingly. He was initially admitted and under control in the State Hospital Intensive Care Unit (ICU) with atrial fibrillation, hypertension, and transient ischemic attack (TIA) diagnosis, and later transferred to AKFA Medline University Hospital neurology department for further treatment.

### Clinical findings

His medical history was negative for diabetes, acute myocardial infarction, tuberculosis, viral hepatitis, and HIV. The initial examination revealed moderate dementia with MMSE score: 11/30, satisfactory general condition, clear consciousness, and disorientation in time and space. He could not accurately determine the present year, mistakenly assuming that the current year is 1951. Moreover, he inaccurately stated that he had six children when his daughter confirmed only four. Furthermore, he experienced challenges with elementary mathematics exercises, including the simple task of adding one to 1951. Experiencing sudden trouble with basic math skills (acalculia) was noted without any typical stroke symptoms like one-sided weakness and speech issues. Acalculia, a consequence of brain damage that might be missed in cases of ischemic stroke, emphasizes complex relationship between cognitive abilities and neurological well-being.

Neurological examination indicated Glasgow Coma Scale (GCS) 15/15, normal pupil reaction without nystagmus. Muscle weakness or paralysis are not detected, no change in muscle tone, absent tremor, deep tendon reflexes (Biceps, Radial brachialis, Triceps, Distal finger flexors, Quadriceps knee jerk, Ankle jerk) are intact with the positive Extensor plantar reflex - Babinski sign (**Table 1**), sensory loss and meningeal signs are not detected.

Reflexes	Grade (Right)	Grade (Left)
Biceps jerk	2+	2+
Radial brachialis jerk	2+	2+



Triceps jerk	2+	2+
Quadriceps jerk	2+	2+
Ankle jerk	2+	2+
Plantar jerk	Extensor	Extensor

**Table 1: Deep tendon reflexes with grading.**

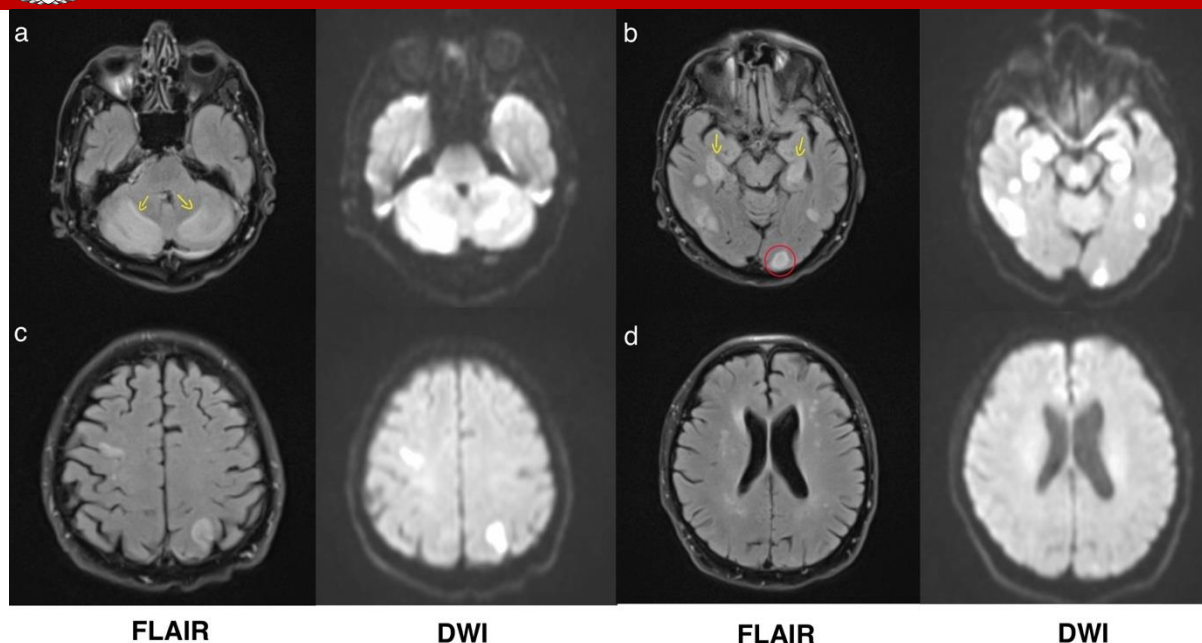
0 = no response (always abnormal); 1+ = a slight but definitely present response (may or may not be normal); 2+ = a brisk response (normal); 3+ = a very brisk response (may or may not be normal); 4+ = a tap elicits a repeating reflex, clonus (always abnormal).

#### Diagnostic assessment

Patient underwent a comprehensive analysis consisting of a complete blood count (CBC), coagulation tests, magnetic resonance imaging (MRI), and echocardiogram. He exhibited a normal CBC except for a slightly elevated white blood cell count, maintained normal glucose control as indicated by an HbA1c level, and showed standard results in biochemistry analysis. However, he presented with an elevated creatinine level in the blood and a significantly increased D-dimer level of 2.79 ngFEU/ml. As for the patient's coagulation tests Prothrombin Time (PT), Prothrombin Time Index (PTI), International Normalized Ratio (INR), activated Partial Thromboplastin Time (aPTT), Thrombin Time (TT), and the fibrinogen level were within normal range.

A cardiology consultation was performed due to the patient's previous experience with arrhythmia. Subsequently, this led to daily monitoring using Holter and echocardiography techniques. After carefully analyzing the laboratory and diagnostic findings, the cardiologist prescribed a relevant treatment plan with further follow-up.

Patient underwent a comprehensive non-contrast multi-slice CT scan of the brain and skull base, augmented by MRI Diffusion-weighted imaging (DWI) (**Figure 1**). This detailed imaging revealed diffusely scattered low-density areas across the cortex and subcortical white matter in both frontoparietal and temporal lobes, including bilateral hippocampal regions (**Figure 1B**). These areas showed a density range of +25 to +28 units. The MRI DWI further highlighted restricted diffusion within both cerebellar hemispheres (**Figure 1A**), indicative of ischemic changes, with identified zones of reduced density measuring +28 to +30 units. Notably, an old lacune in the right basal ganglia is defined by a density of +8 to +10 units and encompassing a maximum size of 2.1 cm. The brain's hemispheres were symmetric but with notable heterogeneity in substance density, characterized by numerous small, low-density areas (ranging from +19 to +22 units) in the periventricular and subcortical white matter (**Figure 1D**). The imaging findings concluded an ischemic stroke on both sides of the MCA territory and the PICA, further corroborated by infarction zones in the cerebellum.



FLAIR

DWI

FLAIR

DWI

**Figure 1: radiographic evidence of multifocal cerebrovascular injury within the MCA and PICA territories, substantiating the diagnosis of an acute ischemic stroke.**

There are multiple T2 FLAIR hyperintensities in both cerebellar hemispheres (yellow arrows) (a), both hippocampus (yellow arrow), occipital (red circle), temporal lobes (b), left parietal and frontal lobes (c), multiple periventricular gliotic changes (d).

#### Management

The management involves a thorough regimen with different classes of medication administered through diverse methods and addressing specific medical issues. The plan starts with the administration of an anticoagulant, antiaggregant, and cholesterol-lowering statin, hypotensive tablets with the dosage adjusted according to blood pressure and pulse. An angiotensin receptor blocker is prescribed once daily. As for cognitive health N-methyl-D-aspartate (NMDA) receptor antagonists are used in the management of dementia. Despite this comprehensive approach, continuous monitoring of the patient's blood pressure and cardiac rhythm was accomplished.

#### Follow-up and outcomes

Patient showed significant improvement within 10 days of hospitalization, with measurable progress in various cognitive and clinical aspects. The stability of his condition is supported by the decrease in his D-dimer values (0.723 ngFEU/ml), which indicate a reduction in clotting activity (or inflammation). His ability to accurately remember a recent year (December 2023) suggests an enhancement in his recent memory skills. However, there are still concerns about his spatial orientation, as he believes he is in his birth city, which is not correct. This could be a sign of spatial disorientation or confusion about his current location, which is seen in stroke patients. On the other hand, his capability to perform subtractions in a series (e.g., subtracting 7 from 100 repeatedly) demonstrates that his mathematical reasoning and working memory are functioning well. His decision not to remember the three requested words might be a result of personal factors. It could indicate problems with memory or a lack of cooperation, as well as psychological issues like anxiety or depression. MMSE score of 24/30 indicated mild dementia. To gain a better understanding of his cognitive skills further, it might



be helpful to conduct a more thorough and consistent neuropsychological evaluation. Monitoring and supportive treatment, which may include activities to improve orientation and memory, could aid in his overall care.

## Discussion

The application of DWI allows for the immediate recognition of recent ischemic injuries using intense contrast. Conversely, FLAIR provides a clear advantage over typical T2-weighted imaging in accurately identifying ischemic lesions, especially those situated near the cerebral spinal fluid region [6]. Moreover, the presence of cognitive impairments, which were initially quantified by MMSE score characterized by disorientation in time and space, a confused sense of the year, and difficulty with calculations align with the clinical manifestations of bilateral thalamic infarction, which can mimic the cognitive deficits seen in alcohol-related conditions [7].

Various factors, encompassing both demographic and health-related aspects, can play a role in determining the likelihood of cognitive decline following a stroke. Our case report on multifocal ischemic stroke reinforces these findings and underscores the necessity for personalized assessments and management plans to effectively address the diverse range of cognitive outcomes observed in individuals who have suffered a stroke [8]. The simultaneous usage of tobacco and excessive intake of alcohol, especially when consuming three or more drinks daily, potentially have a cumulative impacts on the cardiovascular system, while its effects include the formation of blood clots, where each substance influences distinct phases of the development of artery-clogging plaque and the occurrence of sudden clotting events [9].

The study by Schmahmann et al. investigates whether cerebellar strokes can occur without impacting motor control, thereby supporting the theory of non-motor cerebellar regions using the Modified International Cooperative Ataxia Rating Scale (MICARS) to assess motor deficits and MRI/CT for lesion location [10].

## Conclusion

This case demonstrates a rare presentation of multifocal stroke involving both the MCA regions and the PICA, limited to acalculia and memory loss with disorientation to time and place in a patient who maintained an active lifestyle before the event. Remarkably, the patient exhibited no upper or lower limb palsy or weakness in the stroke case. The combination of tobacco use and excessive alcohol consumption has a collaborative impact on cardiovascular well-being, such as the creation of blood clots and the advancement of atherosclerotic plaque, resulting in episodes of acute clotting. The management of such cases requires a multidisciplinary approach, considering both the neurological and systemic implications of the patient's lifestyle and medical history. This case report aims to enhance patient care by meeting various recovery needs and deepening our knowledge of stroke's effects on brain function.

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