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Analysis of Cardio-Embolic Strokes: Clinical and Radiological Perspectives in Morocco

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Abstract

Introduction: Cardio-Embolic Ischemic Strokes (CEIS) are severe strokes caused by emboli originating from the heart. These events are often sudden and severe, leading to significant consequences for patients and the healthcare system. This study aims to analyze the clinical and radiological characteristics of CEIS in a Moroccan population admitted to cardiological emergencies between December 2023 and June 2024.

Methodology: This cross-sectional study included 150 Moroccan patients admitted for CEIS. Inclusion criteria were patients over 18 years old with a diagnosis confirmed by imaging and cardiology. Clinical data included medical history, symptoms at admission, and results of neurological and cardiological exams. Radiological data included results from brain MRIs and CT scans. Data were analyzed using statistical tests to identify correlations between clinical and radiological variables.

Results: The average age of the patients was 68 years, with a standard deviation of 12 years. In terms of gender distribution, 55% were men and 45% were women. Commonly observed risk factors included atrial fibrillation in 60% of patients, hypertension in 70%, and diabetes in 30%.

Regarding clinical presentation, most patients (85%) had a sudden onset with maximal deficit at symptom onset. An isolated focal neurological deficit, such as aphasia or visual field deficit, was observed in 70% of patients. About 10% of patients had a seizure episode at admission. Rapid and spontaneous symptom regression was noted in 15% of patients. More than one vascular territory involvement was evident in 25% of patients, and 5% showed signs of systemic embolization. Finally, 5% of cases began during physical exertion or a Valsalva maneuver, indicating paradoxical embolism.

Complementary exams revealed multiple infarcts in 30% of patients. Half of the patients (50%) had cortico-subcortical infarcts. Hemorrhagic transformation was observed in 10% of patients. Proximal occlusion on a healthy artery was detected in 20% of patients, and rapid recanalization was noted in 15% of cases.

These results illustrate the diversity and severity of the clinical and radiological presentations of CEIS in the Moroccan population studied, highlighting the need for rapid recognition and effective management of these strokes to improve clinical outcomes.

Discussion: CEIS represents about 20-30% of all ischemic strokes [1]. Patients with CEIS often present with a sudden onset of symptoms with maximal neurological deficit from the start. Major risk factors include atrial fibrillation, hypertension, and diabetes. The prognosis of CEIS largely depends on the speed of intervention and management of cardiovascular risk factors. Treatment aims to prevent new emboli formation through anticoagulation. Direct Oral Anticoagulants (DOACs) and Vitamin K Antagonists (VKAs)

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are commonly used for patients with atrial fibrillation. Other treatments may include correcting valvular diseases by surgery or catheterization and removing myxomas.

Conclusion: CEIS constitutes a major medical emergency with distinct clinical and radiological implications. Rapid recognition and effective risk factor management are crucial to improving clinical outcomes and reducing recurrences. Interdisciplinary collaboration between cardiologists and neurologists is crucial for optimal patient care, combining cardiovascular and neurological expertise. This integrated approach is essential to improve patients' quality of life and reduce the impact of these strokes on public health.

Introduction

Strokes are a major cause of morbidity and mortality worldwide. Among these strokes, ischemic strokes, where part of the brain is deprived of blood, represent the majority of cases. A particularly concerning subcategory of these strokes is Cardio-Embolic Ischemic Strokes (CEIS). These events, often sudden and severe, result from emboli formed in the heart that migrate to the brain, causing critical obstructions in cerebral vessels.

The impact of CEIS on public health is considerable, causing significant suffering each year and imposing a heavy economic burden. Studying CEIS is crucial to improving the prevention, diagnosis, and management of these devastating events. Recognizing clinical signs quickly and understanding the specific radiological characteristics of CEIS can significantly improve clinical outcomes and patients' quality of life.

This study aims to detail the clinical and radiological characteristics of CEIS within a Moroccan population admitted to cardiological emergencies between December 2023 and June 2024.

Methodology

Study population: This cross-sectional study included 150 Moroccan patients admitted for ischemic stroke, confirmed to be of cardio-embolic origin, consulting at cardiological emergencies between December 2023 and June 2024. Inclusion criteria included patients over 18 years old with a diagnosis confirmed by imaging and cardiology. Exclusion criteria included strokes of other etiologies.

Data collection

Clinical data

- **Medical history:** Detailed recording of previous medical conditions, including hypertension, diabetes, atrial fibrillation, previous strokes, and other cardiovascular diseases.
- **Symptoms at admission:** Documentation of symptoms at admission, such as hemiplegia, aphasia, and loss of consciousness.
- **Neurological exams:** Results of complete neurological evaluations conducted at admission and during the hospital stay, including NIHSS (National Institutes of Health Stroke Scale) scores.
- **Cardiological exams:** Detailed results of echocardiographies, electrocardiograms (ECG), and other relevant cardiac tests to confirm the cardio-embolic nature of the stroke.

Radiological data

- **MRI results:** Detailed results of brain MRIs, focusing on the location, size, and number of infarcts, as well as the presence of hemorrhagic transformation.
- **CT scan results:** Analysis of brain CT scans to corroborate MRI results and provide additional diagnostic information, particularly in the acute phase.

Statistical analysis

Data were analyzed using appropriate statistical tests to identify correlations between clinical and radiological variables.

Results

Patient demographics

The average age of the patients was 68 years, with a standard deviation of 12 years. Gender distribution showed 55% of patients were men and 45% were women. Frequent risk factors included atrial fibrillation (60%), hypertension (70%), and diabetes (30%).

Clinical presentation

The majority of patients (85%) had a sudden onset with maximal deficit at symptom onset. An isolated focal neurological deficit, such as aphasia or visual field deficit, was observed in 70% of patients. About 10% of patients had a seizure episode at admission. Rapid and spontaneous symptom regression was noted in 15% of patients. More than one vascular territory involvement was evident in 25% of patients, and 5% showed signs of systemic embolization. Finally, 5% of cases began during physical exertion or a Valsalva maneuver, indicating paradoxical embolism.

Complementary exam results: Complementary exams revealed multiple infarcts in 30% of patients. Half of the patients (50%) had cortico-subcortical infarcts. Hemorrhagic transformation was observed in 10% of patients. Proximal occlusion on a healthy artery was detected in 20% of patients, and rapid recanalization was noted in 15% of cases.

Etiologies of embolic heart diseases

Among the etiologies of embolic heart diseases, the high-risk group included patients with atrial fibrillation (60%), left atrial myxoma (5%), valvulopathies (20%), ventricular thrombi (10%), recent myocardial infarction (15%), and dilated cardiomyopathy (10%). The group with non-established risk included patients with a patent foramen ovale (10%), atrial septal aneurysm (5%), mitral annular calcifications (5%), mitral prolapse (5%), calcified aortic stenosis (5%), segmental kinetic disorders (10%), and congestive heart failure (10%).

Discussion

CEIS are defined as strokes caused by emboli of cardiac origin that migrate to the brain and obstruct cerebral arteries. They represent about 20-30% of all ischemic strokes according to various epidemiological studies [1]. Patients with CEIS often have a sudden onset of symptoms with maximal neurological deficit from the start, distinguishing them from other types of ischemic strokes [2].

The prognosis of CEIS largely depends on the speed of intervention and management of cardiovascular risk factors. Major risk factors include atrial fibrillation, hypertension, diabetes, congestive heart failure, and a history of myocardial infarction [3]. Patients with these risk factors should be closely monitored and proactively treated to prevent stroke recurrence.

The TOAST and ASCOD classifications are commonly used to categorize ischemic strokes based on their etiology. The TOAST classification divides strokes into five main subtypes: large artery atherosclerosis, cardio-embolism, small artery occlusion (lacunar), stroke of other determined etiology, and stroke of undetermined etiology [1]. The ASCOD classification is more detailed and includes atherosclerosis, cardiac sources, small vessels, other causes, and dissection. CEIS falls under the cardio-embolism category in the TOAST classification and under cardiac sources in the ASCOD classification.

Cardio-Embolic Ischemic Strokes (CEIS) often present with sudden onset and rapid symptom development, usually reaching maximum intensity within seconds to minutes. This sudden onset of symptoms is due to the abrupt occlusion of a cerebral artery by a cardiac embolus. Clinical characteristics of CEIS include:

- **Maximal neurological deficit at onset:** Most patients present with severe neurological deficits from the onset of symptoms.
- **Isolated focal neurological deficits:** Patients may exhibit isolated focal neurological deficits, such as aphasia (language disorders), visual field deficits (hemianopsia), and motor or sensory deficits on one side of the body (hemiparesis or hemiplegia).
- **Seizure episodes:** About 10% of patients may have seizure episodes at admission.
- **Non-focal symptoms:** Although less common, some patients may present with non-focal symptoms like altered consciousness, dizziness, or ataxia.
- **Stroke recurrence:** Patients with untreated cardiac embolic sources are at high risk of recurrent strokes.
- **Multiterritorial involvement:** About 25% of patients show involvement of multiple cerebral vascular territories due to multiple embolizations.

Brain imaging plays a crucial role in the diagnosis of CEIS. Commonly used imaging techniques include Computed Tomography (CT-scan) and Magnetic Resonance Imaging (MRI). Typical radiological features of CEIS include:

- **Multiple infarcts:** Imaging may reveal multiple infarcts in different vascular territories, suggesting an embolic source.
- **Cortico-subcortical infarcts:** Infarcts often involve both the cortex and the subcortical white matter, reflecting the distribution of embolized arteries.
- **Hemorrhagic transformation:** About 10% of patients may present with hemorrhagic transformation of the infarct, due to reperfusion of the occluded artery.
- **Proximal occlusion:** MRI and angiography may show proximal occlusion of a major cerebral artery, often without underlying atherosclerotic disease in this region.
- **Rapid recanalization:** Follow-up imaging may show rapid recanalization of the occluded artery, especially after thrombolytic treatment or thrombectomy.

The main etiologies of CEIS include atrial fibrillation, cardiac myxomas, valvulopathies, intracardiac thrombi, and cardiomyopathies. The treatment of CEIS primarily aims to prevent new emboli formation through anticoagulation. Direct oral anticoagulants (DOACs) and vitamin K antagonists (VKAs) are commonly used for patients with atrial fibrillation. Other treatments may include correcting valvulopathies by surgery or catheterization and removing myxomas.

Synthesis with literature

CEIS are well documented in the literature, with studies confirming the clinical and radiological characteristics observed in our study. For example, the TOAST classification of ischemic strokes includes cardio-embolism as a distinct category due to its unique clinical and radiological manifestations [1]. Patients with CEIS often present with sudden onset of symptoms, isolated focal neurological deficits, and a tendency for multiple and cortico-subcortical infarcts [4].

Identifying atrial fibrillation as the most common risk factor for CEIS is corroborated by major epidemiological studies. According to the literature, about 15-20% of ischemic strokes are due to cardiac emboli, and atrial fibrillation is present in about 60% of cases [3]. Other causes include cardiac myxomas, valvulopathies, and intracardiac thrombi, all treated by preventive measures such as anticoagulation and appropriate surgical interventions.

Radiological presentations, such as multiple infarcts and hemorrhagic transformation, are also well documented. A study by Kang et al. showed that multiple infarcts in different cerebral territories were strongly indicative of a cardiac embolic source [4].

Our study confirms the observations in the literature on CEIS, highlighting the importance of rapid identification and appropriate management of cardiovascular risk factors to improve patient prognosis. The clinical and radiological characteristics observed in our study population are consistent with those reported in international research, emphasizing the need for a multidisciplinary approach for the diagnosis and treatment of CEIS.

Conclusion

Cardio-Embolic Ischemic Strokes (CEIS) represent a serious and unpredictable threat to public health, particularly within the Moroccan population consulting cardiological emergencies. The results of this study highlight the distinct clinical and radiological characteristics of these strokes, emphasizing the importance of rapid recognition and effective management.

Identifying risk factors such as atrial fibrillation, hypertension, and diabetes is crucial for implementing targeted prevention strategies.

The detailed analysis of clinical and radiological data demonstrates not only the complexity of CEIS but also the potentially devastating impact of these strokes on patients' quality of life. The frequent presence of multiple infarcts and the possibility of hemorrhagic transformations accentuate the severity of these strokes, making rapid and coordinated medical intervention imperative.

This work also underscores the importance of interdisciplinary collaboration between cardiologists and neurologists for optimal management of CEIS. An integrated approach, combining cardiovascular and neurological expertise, is essential to improve clinical outcomes and reduce the risk of recurrence.

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