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Challenges in Diagnosis and Treatment of Cardioembolic Stroke in Young Adults

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ABSTRACT

Cardioembolic ischemic stroke in young adults is an increasingly recognized clinical and public health challenge, differing in etiology and management from strokes in older populations. This retrospective study, conducted at the University Hospital of Annaba between 2020 and 2023, analyzed 48 cases of young adults aged 26 to 55 years diagnosed with cardioembolic stroke (TOAST type II). The most common underlying cause was patent foramen ovale (PFO), found in 62.5% of patients, followed by rheumatic mitral valve disease, acute myocardial infarction, atrial fibrillation, and infective endocarditis. Clinical presentations were typically characterized by hemiparesis and carotid territory infarctions. Management strategies were tailored to each etiology: PFO closure with antiplatelet therapy, anticoagulation for atrial fibrillation and valvulopathies, and guideline-based treatment for myocardial infarction and endocarditis. The in-hospital mortality rate was low (4.2%), but complications such as post-stroke depression, hemorrhagic transformation, epilepsy, and recurrence were observed. The findings underscore the need for early diagnostic workup, etiological classification, and personalized treatment strategies to optimize outcomes and prevent recurrence in young adults with cardioembolic stroke.

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Introduction

Ischemic stroke (IS) in young adults is a rising public health concern due to its impact on individuals in their most productive years, causing long-term physical, psychological, and social consequences [1]. While stroke in older patients is predominantly related to atherosclerosis and chronic comorbidities, young adults frequently present with less typical or cryptogenic causes [2]. Among these, cardioembolic sources such as patent foramen ovale (PFO), valvulopathies, or arrhythmias are of particular importance [3].

Identifying the underlying cause is essential for secondary prevention, as therapeutic approaches especially in cardioembolic stroke are highly dependent on etiology [4].

Methods

This was a retrospective descriptive study conducted at the University Hospital of Annaba (CHU Annaba), Algeria, over a period of 4 years from January 1, 2020, to December 31, 2023. It included 48 patients aged 26 to 55 years who were diagnosed with cardioembolic ischemic stroke (TOAST type II) [5].

Patients were recruited from the departments of Neurology, Emergency Medicine, and Cardiology. Data collection was based on a validated questionnaire, and analysis was performed using Excel 2016 and Epi Info version 2005 [6].

Results

Demographics and Risk Factors

Among 180 young patients admitted with ischemic stroke, 48 (26.7%) were found to have a cardioembolic etiology. The mean age was 43.3 ± 7.38 years, with a slight male predominance (sex ratio 1.09).

The most prevalent vascular risk factors were hypertension (35.4%) and smoking (35.4%), followed by obesity (20.8%) and type 2 diabetes (18.8%) [7]. These findings are consistent with previous African studies on young stroke populations [8].

Clinical Presentation and Infarct Topography

Clinically, 89.6% of patients presented with hemiparesis or hemiplegia, followed by Broca's aphasia and cranial nerve deficits. Radiologically, the carotid territory was involved in 70.8% of patients, multiterritory infarctions in 16.7%, and the vertebrobasilar territory in a minority [9]. These features are suggestive of embolic origin.

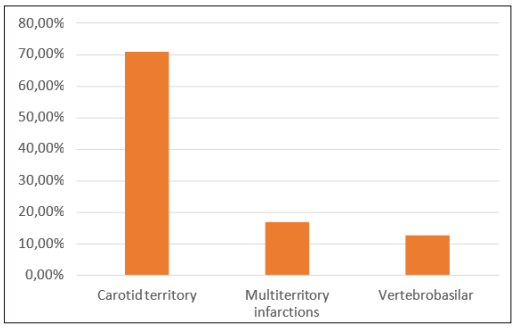

Figure 1: Topographic Distribution of Infarcts

Etiologies of Cardioembolic Stroke

Cardiac sources were stratified as high-risk (39.6%) and low- or uncertain-risk (60.4%). The most frequent etiology was PFO (62.5%), either isolated (43.75%) or associated with atrial septal aneurysm (ASA) (18.75%) [10, 11]. Other causes included rheumatic mitral valvulopathy (14.6%), acute myocardial infarction (10.4%), atrial fibrillation (8.3%), and infective endocarditis (4.2%) [12-15].

Table 1: Distribution of Patients by Underlying Cardiac Causes

Cardiac Etiology	Count	Percentage (%)
Isolated PFO	21	43.75
PFO + ASA	9	18.75
Mitral Valvulopathy	7	14.6
Acute MI (within 1 month)	5	10.4
Atrial Fibrillation (permanent)	2	4.15
Atrial Fibrillation (paroxysmal)	2	4.15
Infective Endocarditis	2	4.2

Therapeutic Management

Patent Foramen Ovale (PFO)

Eligible patients underwent percutaneous PFO closure based on current evidence from randomized controlled trials [16]. Post-procedural management involved dual antiplatelet therapy (DAPT) for 3–6 months followed by lifelong single antiplatelet therapy, in accordance with AHA/ASA and ESC recommendations [3,17].

Atrial Fibrillation (AF)

Patients with AF were treated with oral anticoagulation guided by the CHA_2DS_2-VASc score. Direct oral anticoagulants (DOACs) were used in non-valvular AF, while vitamin K antagonists (VKAs) were preferred in valvular AF, particularly in the setting of mitral stenosis [18].

Valvular Heart Disease

Rheumatic mitral valve disease was treated with chronic oral anticoagulation. In cases with associated atrial fibrillation or significant stenosis, valve replacement or balloon valvuloplasty was considered. Prevention of streptococcal infections and rheumatic fever recurrence was emphasized [19].

Myocardial Infarction (MI)

Patients with recent MI (within 1 month) were managed with DAPT, statins, beta-blockers, and lifestyle interventions according to ESC secondary prevention protocols [20].

Infective Endocarditis

Endocarditis cases required prolonged IV antibiotics. Surgery was indicated for patients with large vegetations (>10 mm), persistent infection, or valve dysfunction. Embolic risk was carefully evaluated before decision-making [21].

Outcomes and Complications

The overall in-hospital mortality rate was 4.2%, which is significantly lower than that reported in other African cohorts [22].

Main complications included

Post-Stroke Depression: 20.8% Hemorrhagic transformation: 16.7%.

Stroke Recurrence: 12.5% (mostly due to non-adherence to anticoagulation) post-stroke epilepsy: 6.3%.

Discussion

Our findings confirm that cardioembolic stroke in young adults is frequent, and PFO is the most commonly encountered cause. The therapeutic benefit of percutaneous closure has been established in randomized trials, particularly in patients <60 years with cryptogenic stroke and high-risk anatomical features (e.g., ASA) [16,23].

Screening for paradoxical embolism including lower-limb Doppler or pulmonary angiography is recommended in suspected PFO-related stroke [24]. Rheumatic valvulopathies remain prevalent in low-resource settings and require long-term preventive strategies [12,19].

Better patient education and adherence monitoring could further reduce stroke recurrence.

Conclusion

Cardioembolic stroke in young adults, though less common than in older populations, has distinct etiologies and therapeutic implications. PFO is the most frequent cause, and percutaneous closure with post-procedural antiplatelet therapy is effective. Rheumatic valve disease, AF, MI, and endocarditis each require individualized treatment approaches. Early etiologic workup and tailored management can significantly improve outcomes and prevent recurrence [1,3,18].

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