When the beat clots

Ischemic stroke in atrial fibrillation

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An emergency room physician is asked to see a 68-year-old male complaining of mild chest discomfort, intermittent palpitations, and worsening shortness of breath. The patient presented to the emergency room with an acute onset of palpitations and states a 3-month history of fatigue. At triage, blood pressure is 135/90 mmHg, respiratory rate is 16 breaths per minute, and an irregular heart rate at 125 bpm at rest is identified. Additionally, his history is notable for a 30-pack-year smoking history and longstanding, reasonably controlled hypertension. On further evaluation, the patient develops increasing confusion and light-headedness.

A 12-lead electrocardiogram (ECG) demonstrates the absence of discrete P waves and an irregularly irregular ventricular rate, diagnostic of atrial fibrillation. However, immediately following the identification of atrial fibrillation on ECG, the patient begins describing a weakness in his left hand. His symptoms progress over the next ten minutes until he can no longer lift his arm and has trouble speaking. Concerned, the emergency physician immediately begins assessment of ischemic stroke.

THROMBOGENESIS IN ATRIAL FIBRILLATION

Atrial fibrillation (AF) is a supraventricular tachyarrhythmia characterized by uncoordinated atrial activation and subsequent diminution of mechanical function.¹ Rapid, ectopic firing of multiple atrial foci, resulting in the asynchronous depolarization of the atria, produces the characteristic cardiac arrhythmia. Due to the rapid and chaotic atrial activity, AF leads to disorganized mechanical atrial function, irregular ventricular rate, and hemodynamic irregularities, ultimately generating a prothrombotic environment.²

The most serious complication of atrial fibrillation is a thromboembolic event, such as an ischemic stroke, which can lead to permanent neurological damage. An ischemic stroke may occur in patients with AF either as the primary presenting manifestation of AF or in patients with previously diagnosed AF despite appropriate medical management. In such patients, a cardiac embolus most frequently originating from the left atrium is thought to be a main source of ischemic strokes in patients with AF.³

INITIAL ASSESSMENT OF ISCHEMIC STROKE IN ATRIAL FIBRILLATION

Atrial fibrillation is the most common cardiac arrhythmia seen in clinical practice and is an important contributor to increased morbidity and mortality, largely due to thromboembolic events such as ischemic stroke.^{4,5} As a result of an acute embolic obstruction to cerebral circulation, an ischemic stroke manifests with the abrupt onset of focal neurologic deficits, with symptoms of stroke

remaining indefinitely if irreversible neurological damage occurs as a result of the cerebral ischemia. As such, prompt assessment and management is key when stroke is strongly suspected. Following the assessment of vital signs and ensuring the stabilization of airway, breathing, and circulation, a focused history and physical examination should be promptly obtained.⁶

The single most influential item with regards to patient history in stroke evaluation is the time of symptom onset, defined as the last known time when the patient was at their previous baseline or symptom-free state.¹ Determining the time of ischemic stroke symptom onset is of crucial importance, and acts a main determinant of eligibility for acute intravenous thrombolysis treatment. For patients unable to provide this information at the time of presentation, consulting patient family members, bystanders, or emergency medical service personnel may be required. After identifying time of symptom onset, a thorough history and physical exam should follow, focusing on identifying the progression of symptoms, possible embolic sources, and any concomitant patient comorbidities that may impact management of an ischemic stroke. Any contraindications to thrombolytic treatment should also be assessed at this time.⁶

An initial neurological examination should be promptly performed following physical examination. Formal stroke evaluations, as guided by documents such as the National Institutes of Health Stroke Scale (NIHSS), have demonstrated clinical utility as a form of rapid neurological assessment, and may be administered successfully by a broad spectrum of healthcare providers.^{7,8} The three most predictive examination findings for the diagnosis of acute stroke are facial paresis, abnormal speech, and arm drift/weakness.^{9,10} Blood should be drawn to evaluate complete blood count, platelet count, blood glucose, electrolytes, cardiac markers, and coagulation studies. Furthermore, timely brain imaging remains critical to the rapid evaluation and diagnosis of patients with potential ischemic strokes. Imaging may be used to exclude the presence of intracranial hemorrhage, assess the degree of brain injury, and identify the vascular lesion responsible for the ischemic deficit. Either computed tomography or magnetic resonance imaging may be used as the initial imaging modality for the emergent assessment of patients with suspected stroke.⁶

The emergency physician, quickly recognizing the signs of stroke and noting the onset of stroke symptoms, immediately begins the clinical stroke evaluation using the NIHSS. Blood is drawn, immediately sent to the laboratory, and imaging studies are arranged. An urgent consult to the stroke service is made and decisions for early management are considered.

ACUTE MANAGEMENT OF ISCHEMIC STROKE

Following the diagnosis of ischemic stroke, timely restoration of cerebral blood flow using fibrinolytic therapy is the most effective pharmacological maneuver for salvaging viable ischemic brain tissue.¹¹ As previously mentioned, the single most influential item with regards to patient history is the time of symptom onset, in order to aid in determining the eligibility for acute intravenous fibrinolytic treatment. Additionally, any contraindications to intravenous thrombolysis must also be strictly evaluated.⁶

For eligible patients with acute ischemic stroke, intravenous fibrinolytic therapy in the form of intravenous recombinant tissue-type plasminogen activator (rtPA) alteplase is currently the widely accepted approach.^{12,13} Timely thrombolytic therapy administered within the therapeutic window, recognized as within 4.5 hours from symptom onset, has demonstrated significant reductions of long-term disability with no increase in long-term mortality.^{14,15} Most importantly, earlier treatment is more likely to result in favorable outcomes, further emphasizing the importance of timely emergency department evaluation and diagnosis of ischemic stroke.¹⁶

Intracranial hemorrhage remains the major risk of intravenous rtPA treatment, with early neurological symptoms associated with intracranial hemorrhage occurring in 6.4% of patients treated with intravenous rtPA.¹⁷ Thus, strong emphasis must be placed on initial assessment and patient history to ensure appropriate selection of patients for intravenous fibrinolysis.

For patients ineligible for intravenous rtPA, a number of endovascular treatment options have become available including intra-arterial fibrinolysis, mechanical clot aspiration or retrieval, and acute angioplasty with stenting. Although these therapies may offer favourable outcomes, these alternative therapies should be pursued only in a highly selected patient population ineligible for intravenous rtPA and in centres well equipped for these modalities.¹

Returning to the case, the initial investigations and imaging results return and demonstrate early signs of cerebral infarction and identify the site of thromboembolism. Additionally, the imaging results exclude any signs of intracranial hemorrhage. Without any contraindications to fibrinolytic therapy, and presenting within the narrow therapeutic window, the patient is started on intravenous rtPA and monitored closely for the next 24 hours.

LONG-TERM PREVENTION OF THROMBOEMBOLISM IN ATRIAL FIBRILLATION

Long-term management of patients with AF often involves three considerations: rate control, rhythm control, and prevention of thromboembolism. Initially, the AF management decision involves the determination between either a rate or rhythm control strategy; however, regardless of which strategy is pursued, attention must also be directed to antithrombotic therapy for prevention of thromboembolism.¹⁸

Multiple clinical strategies have been proposed to stratify the risk of ischemic stroke in patients with AF to determine which patients might benefit from antithrombotic therapy. A currently accepted stratification scheme, the CHADS₂, integrates elements

from several strategies and identifies patients which will benefit from antithrombotic therapy. The CHADS₂ scoring system is a point-based system in which 2 points are assigned for a history of stroke or transient ischemic attack, and 1 point each is assigned for the presence of cardiac failure, hypertension, diabetes, and age over 75 years.¹⁹ In patients with AF and a CHADS₂ score ≥ 1 , long-term oral anticoagulation with warfarin or a new anticoagulant, such as apixaban, dabigatran, or rivaroxaban, unless contraindicated, is recommended. Patients with a CHADS₂ score of 0, if over 65 years, still benefit from long-term oral anticoagulation, while patients with AF and no additional risk factors need no therapy.¹⁸ Antithrombotic therapy has been shown to successfully lower the risk of embolization in all patients with AF, however its use is associated with an increased risk of bleeding and requires monitoring for risk of bleeding complications.^{20,21}

Due to the rapid response and recognition of the signs of ischemic stroke by the emergency physician, the patient suffered only minimal neurological sequelae. During the recovery from his ischemic stroke, the patient is educated on his arrhythmia and metoprolol is initiated to achieve rate control. Anticoagulation is also initiated to reduce the risk of further stroke—his CHADS₂ score is 3. He is followed up by a cardiologist to review the management of his atrial fibrillation and risk for recurrent stroke. Further discussions are made to ensure proper maintenance of his hypertension and discuss future considerations for smoking cessation.

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