Cryptogenic Stroke
When and How Should You Look for Arrhythmias?

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KEYWORDS

• Cryptogenic stroke • Atrial fibrillation • Arrhythmia • Mobile cardiac outpatient telemetry

KEY POINTS

- Subclinical atrial fibrillation (AF) is a common cause of cryptogenic stroke.
- Longer monitoring improves detection rates of subclinical AF.
- Incorporation of risk factors predicting patients at higher risk of stroke can be used to target populations suitable for longer-term monitoring.
- Although longer duration of AF would be expected to increase the risk of stroke, the exact cutoff for duration of clinical significance is not yet established.
- It seems probable that a combination of clinical risk factors and duration of AF will provide the best prediction of future clinical stroke.

CRYPTOGENIC STROKE

Cryptogenic stroke specifically encompasses patients who have had brain infarction of unknown etiology after an extensive cardiac, vascular, and serologic evaluation has failed to identify a recognized cause.[1] This category continues to account for 30% to 40% of ischemic strokes[2,3] despite a growing armamentarium and refinement of diagnostic modalities. Early angiographic studies demonstrated that most of these events were not attributable to large-artery thrombosis.[4] Serial angiographic studies reinforced the hypothesis that many of these strokes were related to embolic material that would disappear within a few days of the initial insult.[5,6] Embolic occlusions undergoing spontaneous thrombolysis could be seen in most of these patients, with more than 80% having demonstrable potential embolic sources in one study.[7]

THE IMPORTANCE OF ATRIAL FIBRILLATION

Atrial fibrillation (AF) is the most common cardioembolic source of ischemic stroke, and can be found in 1 in 4 patients presenting with their first episode of stroke.[8,9] Unfortunately, only 5% of patients present with AF on their electrocardiogram (ECG) or on telemetry during their index hospitalization, leaving a large proportion of AF undetected.[10] Patients who experience an AF-related stroke will benefit from anticoagulation as a measure for secondary prevention. Anticoagulation therapy after detection of AF provides an additional 40% reduction in risk compared with antiplatelet therapy alone,[11] and overall a 65% relative risk reduction for stroke.[12] Patients with cardioembolic strokes suffer the greatest long-term mortality in comparison with other stroke subtypes, even after adjusting for comorbidities and stroke severity,[13] thus making the identification of AF in patients

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who have suffered a stroke of paramount importance.

AF is often paroxysmal and can be asymptomatic or associated with vague symptomatology, making it difficult to document in a patient presenting with stroke. Patients with paroxysmal AF (PAF) have a similar risk of stroke when compared with patients with chronic AF, and experience similar reduction in the risk of recurrent strokes.[13] Subclinical AF is thought to be associated with a 2.5-fold increased risk of ischemic stroke or systemic embolus, and many speculate that it accounts for a significant proportion of patients with cryptogenic strokes.[14] This article outlines the current evidence and indications for ECG monitoring in documenting subclinical AF in patients with cryptogenic stroke. In addition, evidence to date regarding risk factors of AF that may inform further testing is briefly reviewed.

Because only a proportion of patients with suspected AF are identified on their index hospitalization for stroke, the search for AF often extends to the outpatient setting. Of note, despite ubiquitous inpatient telemetry for patients admitted with an acute ischemic stroke, a health care worker is generally required to appropriately recognize and act on an episode of AF, a task not without obstacles in a busy hospital setting. In one study, 6% of patients admitted to a stroke unit at an academic medical center had AF that was missed on telemetry but was detected by concurrent Holter monitoring once reviewed by an overreading physician.[15] AF detection usually relies on outpatient ECG monitoring, which may extend the yield of AF to an additional 6% to 8% of patients, with longer recordings producing greater yield.[16] This approach provides the rationale for longer periods of surveillance, the duration of which is to be determined. Outpatient monitoring is currently highly variable and is dictated by physician preference, local availability, and infrastructure.

OPTIONS FOR OUTPATIENT ELECTROCARDIOGRAPHIC SCREENING OF ATRIAL FIBRILLATION

Since the development of the Holter monitor in the 1940s, there has been progressive improvement and refinement in ambulatory ECG monitoring. In 1999, the American College of Cardiology and the American Heart Association released practice guidelines categorizing ambulatory monitors as either continuous short-term recorders (24–48 h) or intermittent longer-term recorders, the latter being loop recorders with or without the requirement for patient activation.[17] Current systems typically consist of 3 to 5 ECG electrodes yielding 2 ECG vectors and a third derived ECG (**Fig. 1**). The ECG signals are acquired at up to 1000 samples per second in an effort to obtain high-fidelity

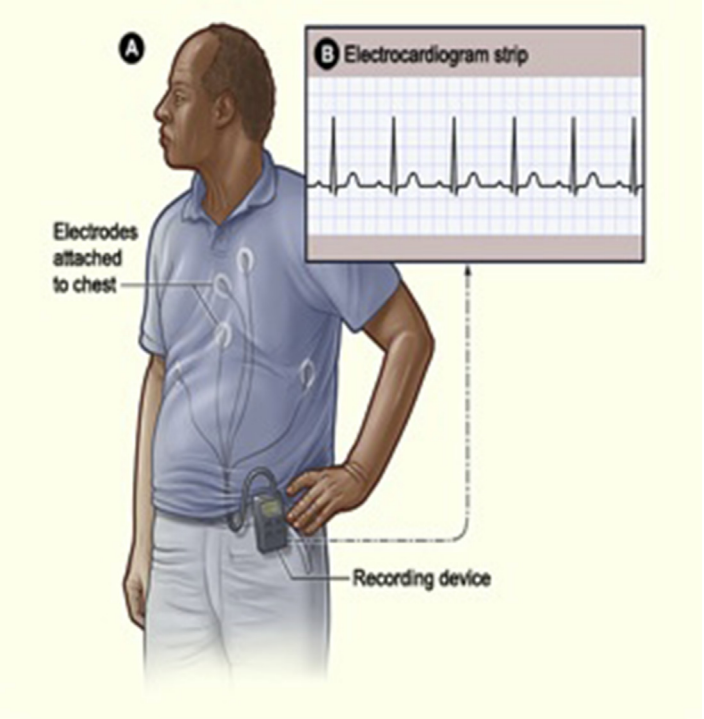

Fig. 1. (*A*) How a Holter or event monitor attaches to a patient. In this example, the monitor is clipped to the patient's belt and electrodes are attached to his chest. (*B*) An electrocardiogram strip, which maps the data from the Holter or event monitor. (*From* What to expect while using a Holter or event monitor. National Heart, Lung, and Blood Institute Web site. Available at: http://www.nhlbi.nih.gov/health/health-topics/topics/holt/while.html. Accessed October 1, 2013.)