Approximately 10% of people 70 years of age have atrial fibrillation, and the incidence dramatically increases with age. At least one third of these experience no symptoms. The condition confers a 4- to 5-fold higher risk of ischemic stroke, and in 10% of all ischemic strokes, atrial fibrillation is first detected at the time of stroke. Despite these sobering statistics, research is revealing that individuals may already own a device that can alert them of their hidden arrhythmia.

“Stroke is not a good early warning sign of atrial fibrillation,” said Ben Freedman, MBBS, PhD, a professor of cardiology at Concord Hospital and a deputy director of the Heart Research Institute, Charles Perkins Center at the University of Sydney in Australia. “Strokes related to atrial fibrillation are preventable by anticoagulants, so it makes sense to look for the arrhythmia in asymptomatic people as a strategy to prevent stroke.”

Investigators are actively testing whether recent technologies such as smartphones and similar devices might be harnessed to detect which individuals may have atrial fibrillation and should undergo an ECG to obtain a definitive diagnosis. The need is great: Atrial fibrillation is a global healthcare problem that is increasing in prevalence and incidence. The estimated number of individuals with atrial fibrillation in 2010 was 33.5 million, with annual new cases at close to 5 million.

“Screening for atrial fibrillation has been recommended, but population implementation is yet to be carried out,” said Jaspal Taggar, MRCGP, MSc, a clinical assistant professor in primary care at the University of Nottingham in the United Kingdom. “Current recommendations advocate pulse palpation for this first step of detection; however, our work demonstrated that pulse palpation has the lowest accuracy for detecting pulse irregularities compared with newer technologies.”

Taggar explained that this is due to a low specificity of pulse palpation, which results in more false-positive cases of suspected atrial fibrillation, and these patients are then referred to undergo electrocardiography. In a recent systematic review and meta-analysis that included 21 published
studies and 15,129 pulse assessments, Taggar and his colleagues reported that non–12-lead ECG devices, modified blood pressure monitors, and smartphones were more precise than pulse palpation for detecting pulse irregularities caused by atrial fibrillation. They noted, however, that only 3 studies investigated smartphones, and all of them were small in sample size.

Larger studies will be needed to confirm the accuracy of smartphone apps, which typically rely on the principle of photoplethysmography to detect atrial fibrillation. The apps use the smartphone flash/bright light to shine a light through the finger and the video camera to record a continuous photo sample that is analyzed by the app to produce a pulse wave. “Basically, these apps just detect the pulse and perform better at diagnosis of atrial fibrillation than fingers palpating the pulse to detect irregularity,” said Freedman.

He noted that although these apps perform quite well in standardized settings, they may not be as effective when used by patients to test themselves. “Specificity may be limited by noisy information. Noise is a problem to all apps and devices that use an algorithm to diagnose an arrhythmia, and in the hands of the public, a small drop in specificity results in a lot of false positives, which becomes even more of an issue if people are testing themselves frequently.” Similar technology is now being built into smartwatches and wristbands, with the same or even greater limitations from noise and movement. Another device that can diagnose atrial fibrillation from the pulse wave is the oscillometric sphygmomanometer, which checks blood pressure and then uses an algorithm to diagnose atrial fibrillation.

Such technologies will likely be useful only for uncovering potentially hidden cases in patients if they are followed up with a 12-lead ECG for a definitive diagnosis. “The big thing is to correctly diagnose atrial fibrillation in the first instance and then start treatments to prevent stroke,” said Taggar.

In addition to smartphone camera apps and sphygmomanometers, a miniaturized ECG that sits on the back of a smartphone can be used for atrial fibrillation detection. For example, the AliveCor Kardia Mobile ECG device comes with an attachment plate with adhesive that can be used to attach the monitor to an existing case or directly to the mobile device itself. It has 2 silver electrodes held by fingers of the right and left hands to generate a lead 1 ECG, and the device transmits recordings to the smartphone via the microphone and an app. This goes considerably beyond photoplethysmography to provide information that may not be felt at the pulse. “Ultimately, the diagnosis of atrial fibrillation requires an ECG, and this is recognized in all guidelines. An ECG recorded by such a device can be overread by an expert to make the diagnosis,” said Freedman. “There are also other handheld devices that produce an ECG but are not a smartphone. These include the Mydxnostick and the Omron devices, which can be plugged into a personal computer to display the ECG waveform, or the Zenicor device, which transmits data via the wireless phone internet to a server for diagnosis of the rhythm and viewing the trace.”

Unfortunately, all of these devices are subject to interference from noise and movement, but continued improvements in technology will likely address these shortcomings. As investigators and developers strive to develop inexpensive, quick, simple, and accurate methods to detect atrial fibrillation both in the clinic and at home, Freedman stressed that there cannot be a one-size-fits-all solution to screening, and the best device will need to be individualized to the situation and the healthcare system.
Handheld Technologies May Lead to Better Detection of Atrial Fibrillation
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