

Global positioning tracker may better gauge severity of peripheral artery disease

A space-based technology may provide an inexpensive and more reliable way to gauge the walking capacity in many patients with peripheral artery disease (PAD), whose clogged leg arteries cause them severe pain when they walk, according to a report in *Circulation: Journal of the American Heart Association*.

A Global Positioning System (GPS) uses a constellation of at least 24 medium earth orbit satellites that transmit precise microwave signals. This enables a GPS receiver to determine its location, speed, direction and time.

Using the GPS and a simple computer spreadsheet, researchers traced and analyzed the maximal walking distance (MWD) of 24 PAD patients as they strolled through a public park. MWD is the maximum distance a person can walk at one time at a normal pace on a flat surface before leg pain forces them to rest.

“We found that MWD obtained at a person’s usual pace is largely superior to the MWD measured on a treadmill,” said Pierre Abraham, M.D., Ph.D., senior author of the study and a physician in the vascular investigation laboratory at University Hospital in Angers, France. “GPS may allow for a more objective measurement of walking capacity in patients with PAD.”

If additional studies confirm the findings, Abraham envisions the GPS assessing other diseases, including heart failure and low oxygen levels induced by exercise in the blood of respiratory disease patients.

PAD, which is caused by the same build-up of fatty deposits that narrow heart arteries, affects about 8 million Americans. The risk of PAD increases with age, and people with the disorder have a four to five times increased risk of dying of cardiovascular disease.

A treadmill MWD is the standard means to assess PAD severity and a key factor physicians use in proposing treatment. However, treadmill MWDs are time-consuming, must be done in vascular laboratories and don’t correlate with either the maximal walking distance or peoples’ perception of their disability resulting from PAD.

“Patients often report their walking capacity varies from one day to another and also varies from one moment to another within a single stroll,” Abraham said.

Studies using expensive professional GPS devices had previously demonstrated that the satellite-based system could accurately record the distances people walked. However, GPS’s usefulness in following PAD patients had never been tested.

To gain a better understanding of the effect of normal walking on such patients and how this compared with treadmill MWDs, the team equipped 18 men and six women with a \$450 commercially available GPS device and analyzed their movements recorded as each walked in a public French park.

“GPS allows for the analysis of the distance walked, of course, but also the speed, duration of resting and the number of walking bouts over a prolonged recording period,” Abraham said.

Study participants, who ranged from 39 to 79 years old, were instructed to walk at their usual speed for at least 45 minutes, including rest breaks required by leg pain. When pain struck, they were told to stop walking rather than slow down. The length of each rest period was left up to the patient.

Analysis of the recorded data revealed that MWDs obtained outdoors were significantly better than treadmill-determined MWDs in three areas:

- GPS-measured distance showed a better relationship to the treadmill than the patient's self-estimates of how far they could walk on a flat surface before pain forced them to stop.
- When participants walked unsupervised for 45 minutes outdoors, their MWD before they had to stop was greater than when they walked a hallway for six minutes with a researcher encouraging them every two minutes.
- Patients had longer MWDs when they walked in the park than on a treadmill. "Most patients reported that the unconstrained outdoor walking better reflected their usual walking capacity compared to the treadmill," Abraham said.

Researchers must resolve many clinical and technical questions before measuring MWD via satellite becomes an everyday tool for cardiologists, Abraham said. These include determining:

- The reliability of measurements from one GPS device versus another from the same company, or from different companies.
- The optimal sampling rate for recording data.
- The optimal minimum recording time to determine a MWD under normal living conditions.
- Whether patients would walk differently if asked to do so for a specific distance rather than a minimal time.

Even when all such questions are settled, Abraham does not envision GPS replacing treadmills entirely for measuring MWD. They will be needed to compare patients because the treadmill technique is standardized, he said. They also simultaneously record multiple physiological measurements, such as blood pressure, oxygen consumption and heart rate, and test patients who are uncertain about or can't participate in GPS-based measurements.

Source: American Heart Association

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