Developing a test to save eyesight by detecting glaucoma years earlier

March 24 2010

A person with advanced glaucoma could have this view of the world, a risk that might be reduced by a new early diagnostic test for the common eye disease. Credit: National Institutes of Health

Scientists are reporting progress toward a test that could revolutionize the diagnosis of glaucoma -- the second leading cause of vision loss and blindness worldwide -- by detecting the disease years earlier than usually happens at present. They reported the findings here today at the 239th National Meeting of the American Chemical Society (ACS).

"We are confident that we're moving toward a breakthrough that will allow us to detect glaucoma at its earliest stage," said Chenxu Yu, Ph.D., who headed the study. "We hope it will benefit millions of glaucoma patients and individuals at risk for this devastating eye disease worldwide."

Glaucoma is a group of eye disorders that can damage the optic nerve, which carries visual information from the eye to the brain. It usually occurs when fluid pressure inside the eye slowly increases over time. The fluid presses on the optic nerve and damages it. Glaucoma affects about 70 million people worldwide, including about 2 million in the United States. It damages vision by stealth, with no obvious warning symptoms that would send patients to a doctor. There is no cure, and glaucoma causes irreversible loss of vision.

Doctors now use two main techniques to detect the disease. One test is tonometry, which measures eye pressure by gently touching a special instrument to the outer surface of the eye. The other is ophthalmoscopy, in which an eye specialist uses an instrument called an ophthalmoscope to look directly through the pupil of the eye at the optic nerve. The nerve's color and appearance can indicate the presence of damage from glaucoma.

"All too often, these tests detect glaucoma after the disease has been silently causing damage to the optic nerve," Yu explained. "Years may pass between the first biological change associated with glaucoma inside the eye and diagnosis. We need ways of diagnosing glaucoma earlier, before permanent damage has occurred, so that patients can begin taking medication to control it."

In their ACS report, Yu and colleagues described development and early testing of a potential new early diagnostic method. It gives a mainstay tool in chemistry labs — Raman spectroscopy — a potential new life in medicine. The technique as used in chemistry and other laboratories involves focusing a beam of infrared laser light — invisible to the human eye — into a test sample to get information about the sample's composition. Yu's method uses Raman spectroscopy to shine laser light through the pupil of the eye. Optic nerve cells (retinal ganglion cells) inside the eye scatter the light, producing a rainbow-like "spectrum" or

pattern revealing the chemical composition of the cells. Scientists can then use that snapshot to identify biochemical changes in retinal cells that announce the presence of glaucoma.

Efforts are underway to use Raman spectroscopy — named for an Indian scientist who won the Nobel Prize for developing it — elsewhere in medicine (i.e., cancer diagnosis). But Yu described this research as among the first attempts to apply the Raman technology to diagnosis of glaucoma.

Yu and his colleague, Dr. Sinisa Grozdanic, a glaucoma researcher and Director of Animal Research for the Iowa City Veterans Administration Center for Treatment and Prevention of Vision Loss (VA CPTVL), are pleased with results of animal retinal tissue testing from glaucomatous dogs, in which the technique detected glaucomatous changes with 90 percent accuracy, the scientists say.

""This is a very promising technique," said Yu, an assistant professor at Iowa State University in Ames. "We are very excited about the results so far and look forward to additional studies."

The scientists look forward to potential clinical trials in humans. If animal studies go well, and show good efficacy and safety of methodology, the technique could be ready to be used in eye doctor's office within five years, they estimate. The test likely will take about 30 minutes, longer than existing glaucoma tests, but may benefit patients with more accurate diagnosis of disease, Yu said.

Provided by American Chemical Society

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