Rapid X ray opens window to arteries

A century ago, a photographer used high-speed photos to prove that a galloping horse lifts all four hooves off the ground.

Today, the same principle of rapid exposures drives a $2 million device known as an ultrafast CT scanner. Capturing 10 X-ray images each second, the scanner enables doctors to peer into pulsing coronary arteries and identify blockages with 95 percent accuracy.

As any camera buff knows, rapid exposures can record an instant so brief that a moving object registers as a still image on film. Standard CT scans, in contrast, require exposures lasting 2 seconds. "When you're shooting with a conventional scanner, you get a blur," says Arthur S. Agatston, of Mount Sinai Medical Center in Miami Beach, Fla., one of 12 researchers at six medical centers nationwide who report their findings in the March 1 CIRCULATION.

The new technique depicts fatty deposits, called plaque, which obstruct blood flow. The scans can detect plaque because it is laced with calcium, which X rays cannot penetrate. On standard CT scans, these deposits show up indistinctly; on ultrafast CT scans, they stand out clearly.

Using both ultrafast CT scans and conventional angiography, the researchers studied 710 people with suspected heart disease. The CT scans detected plaque in 404 of 427 patients with blocked arteries. Of the patients in whom the scans failed to detect blockages, only four had two or more blocked arteries.

Consequently, the researchers calculate, ultrafast CT scans predict 90 percent of coronary artery disease in people with a single blocked artery and at least 97 percent in people with multiple blocked vessels.

If the technique lives up to its promise, Agatston says, many fewer people may have to undergo angiography. In this invasive diagnostic procedure—performed on an estimated 1 million people each year—doctors poke a catheter into a leg artery and guide it to the heart, where they flood the arteries with dye that shows up on X-ray images.

Angiography has its risks. One in 500 patients suffers a heart attack or stroke caused by blood clots or plaque dislodged by the catheter; 1 in 1,000 dies.

Though noninvasive, ultrafast CT scanning remains controversial. Some cardiologists do not believe the technique portrays the internal anatomy of the arteries in enough detail for physicians preparing to perform surgery. Also, because older people have more plaque, the test becomes increasingly difficult to interpret as patients age, says Donald P. Harrington of the State University of New York School of Medicine at Stony Brook and former chairman of the American Heart Association council on cardiovascular radiology.

Agatston counters that ultrafast CT scanning is accurate enough to rule out coronary artery disease in many patients. By a series of calculations that improve the specificity of the findings, he says, overall accuracy can reach more than 95 percent. — *S. Sternberg*

Drop in ozone killers means global gain

Measurements of ozone-destroying compounds in the atmosphere show these chemicals declining in abundance for the first time—a significant step toward the eventual recovery of the life-sustaining ozone layer.

The reported turnaround comes 9 years after the signing of the Montreal Protocol, an international treaty that restricts the use of ozone-harming chemicals containing chlorine and bromine. The protocol and its subsequent amendments are gradually weaning the world from a half century of reliance on chlorofluorocarbons (CFCs) and other halocarbons.

According to measurements made at seven sites around the globe, total concentrations of chlorine and bromine compounds in the lower atmosphere peaked recently and have now started to drop, reports Stephen Montzka of the National Oceanic and Atmospheric Administration (NOAA) in Boulder, Colo. He described these results at the annual meeting this week of NOAA's Climate Monitoring and Diagnostics Laboratory.

Chlorine pollution from industrial compounds topped out at the start of 1994 and has decreased at 1 percent per year since then. That decline is strong enough to outweigh ongoing increases in bromine concentrations, even though each bromine atom has 40 times the destructive potential of a chlorine atom, says Montzka. Bromine in the atmosphere comes principally from halons and methyl bromide.

The observations come as welcome news to governments, environmental groups, and chemical manufacturers and users, all of whom have worked toward implementing the protocol and its amendments. Despite fears that certain countries might renege on their pledges or illicitly produce banned chemicals, the atmospheric concentrations reflect general compliance with the treaty.

"We'd expect this [turnaround] to occur as long as everything went according to the book," says Montzka.

Another group of scientists, however, questions whether the reversal has occurred. Ronald G. Prinn of the Massachusetts Institute of Technology and his colleagues monitor chlorine and bromine compounds using a separate set of global stations. Their work shows that the atmospheric abundance of chlorine has reached a plateau, but they cannot say with confidence that concentrations have started to drop significantly.

Even if the destructive potential of the lower atmosphere has started to decline, ozone recovery will lag behind. It will take 2 or 3 years for recent trends to filter up to the stratosphere, home of the ozone layer.

If ozone healing begins near the end of the century, convincing signs of improvement may not appear for another decade, says Charles H. Jackman of NASA's Goddard Space Flight Center in Greenbelt, Md. Because globally averaged ozone concentrations swing up and down naturally from year to year, scientists must wait until they see those concentrations climb by several percent before they can identify dividends attributable to the Montreal Protocol.

"If everything goes well, by 2010 we should see that ozone has recovered enough" to be confident about the progress, says Jackman.

The Antarctic ozone hole, however, will continue to reappear each southern springtime until around the year 2050, he adds. — *R. Monastersky*

Principal Ozone-Harming Compounds

Compound	Use	Phaseout Deadline for Developed Countries*
Chlorofluorocarbons (CFCs)	Refrigeration, air conditioning, foam blowing, aerosol propellant, cleaner	1/1/96
Halons	Fire suppression	1/1/94
Carbon tetrachloride	Chemical manufacturing agent	1/1/96
Methyl chloroform	Cleaner and degreaser	1/1/96
Hydrochlorofluorocarbons (HCFCs)	Replacement for CFCs	2030 (with earlier restrictions)
Methyl bromide	Agricultural fumigant	2010 (1995 freeze in production levels)

*Developing countries have a delayed phaseout schedule.