Biomedicine

Diane D. Edwards reports from Anaheim, Calif., at the 60th annual Scientific Sessions of the American Heart Association

Lasers and tips and drills, oh my!

You might think of high-tech hardware stores, or even of the annual gem-and-mineral show, when you hear what's happening in medicine to open clogged blood vessels. Researchers are studying the use of lasers, dentistry-type drills and sapphire-tipped catheters to remove the plaque made of cells and cholesterol that can form inside arteries. They also are testing sound waves and heat to destroy unwanted buildup.

"Return of the occluded artery" could be the title of a horror film viewed too often by cardiac patients and physicians. For example, of the estimated 150,000 balloon angioplasties – in which balloon-tipped catheters force open blocked arteries – performed this year in the United States, more than 30 percent will have to be followed by vessel renarrowing within seven years, according to a recent study (SN: 5/16/87, p.311). To help prevent this, physicians have used aspirin and other blood-thinning drugs. Others report preliminary success with preventive administration of dietary fish oil to minimize vessel constriction and blood clotting that might lead to blockage. But some scientists are trying to improve the angioplasty procedure itself or supersede it with other techniques.

Conventional angioplasty sometimes leads to plaque fragmentation and the possible release of "chunks" large enough to block blood flow elsewhere in the body. By adding a laser to the system, say scientists, physicians may be able to smooth rough spots on vessel walls with heat and melt plaques rather than break them into pieces. Some experimental laser catheters consist of optical fibers tipped with sapphires that focus the heat; others use tips of gold or other heat-conducting materials.

Physicians at the San Francisco Heart Institute at Seton Medical Center have used these same principles to "weld" together human arteries with lasers, a possible suture-replacing procedure they've performed in more than 15 patients this year. Several researchers said that data from these and other laser studies in animals and a handful of human patients look promising.

With a sound-wave-emitting lithotriptor machine that disrupts kidney stones, researchers at Cedars-Sinai Medical Center in Los Angeles caused "mini-explosions" of the calcium and clotting proteins found in plaque along vessel segments excised for the experiments. But half the segments also tore, so Robert J. Siegel and his co-workers built a modified machine with a probe that can be aimed at the blockage – and shattered plaques within 2 to 60 seconds with much less damage to vessels. Particles shed by the exploded plaques apparently are small enough to be safe, says Siegel.

In other work, the whining noise made by a "mechanical rotational atherectomy device" is reminiscent of a dentist-office serenade, but the device drills through arterial plaque, not teeth. Scientists at Baylor College of Medicine in Houston have now reported results from the first use of the drill in humans. Threaded through vessels with a catheter as in angioplasty, the drill rotates at 120,000 rpm and removes rather than compresses plaque. In the seven patients treated, vessel blockage was reduced from 90 percent to less than 20 percent. Studies show that debris particles usually are the size of dust and are harmless, says Baylor's Nadim Zacca.

Implanting 'stents' with staying power

Another approach to treating renarrowed arteries has produced the latest in implantable cardiac-care gadgets. In order to give these newly opened vessels some "backbone," researchers are placing tubes called stents inside the affected area. All the various stents discussed at the Anaheim meeting are designed to hold open a vessel that threatens to close, but they differ in structure. There are about a dozen models being evaluated worldwide. The only one thus far approved by the Food and Drug Administration for clinical use was developed at the University of Texas Health Science Center in San Antonio.

Made of a tube of collapsed stainless steel mesh, the Texas stent is delivered to a partially blocked artery on a balloon catheter, which opens up the stent as the balloon expands (the balloon catheter is then removed). About a half-inch long and the diameter of spaghetti before expansion, the stent has been used successfully in 13 patients in Texas and West Germany, says Richard A. Schatz, now at the Arizona Heart Institute Foundation in Phoenix. The first was implanted about six months ago, and all treated vessels are still open, he says. This particular stent, however, has not been approved for use in the heart's own arteries, but is used mainly in the arms and legs. Approval for use in the heart awaits more conclusive results in animal experiments. Other stents – being tested at Vaudois University Hospital Center in Lausanne, Switzerland, and at Emory University School of Medicine in Atlanta – are performing well when placed in coronary arteries, say their designers. An added feature of these models, say the Swiss and Atlanta scientists, is their flexibility, which allows them to bend along twisting vessels.

Will tPA force changes in cardiac care?

Federal approval of the clot-dissolving drug called tissue plasminogen activator, or tPA – announced just before researchers and clinicians gathered in Anaheim – made a big splash among cardiac physicians and economic analysts aware of the drug's potential market (SN: 11/21/87, p.325). Lauded as superior to current clot-dissolving drugs because of its specificity, tPA binds to and acts on certain proteins in the clot, rather than nonselectively destroying similar proteins also found circulating in the blood. The genetically engineered drug is expected to restore blood flow and thus minimize heart tissue damage in many thousands of heart attack victims. But observers say that tPA's endearing qualities may rattle medicine's approach to cardiac care.

Besides being so specific, tPA dissolves clots rapidly. But it must be administered quickly to be effective. Injection of the drug within six hours of the first symptoms is recommended, and researchers agree the sooner the better. But how, when many people do not realize at first that they are having a heart attack, can the drug be administered immediately? And what about the time it now takes to determine whether a patient in the emergency room has had an attack?

The public and physicians need a "raising of consciousness" regarding heart attacks, says Eugene M. Braunwald of Brigham and Women's Hospital in Boston. Along with this increased knowledge, however, hospital staff will see "a massive augmentation" of frightened patients whose chest pains are not due to a heart attack, predicts Alan M. Ross of George Washington University Hospital in Washington, D.C.

With tPA now available, there may be a need for specially trained emergency-room nurses to identify heart attack victims before the doctor comes, says Braunwald. But researchers suggest that the best therapy approach might be to give tPA before a patient even reaches the hospital. A recent study in West Germany found that important minutes were saved by tPA-injecting, ambulance-riding physicians. "We may have to start making house calls again," says George A. Beller of the University of Virginia Medical Center in Charlottesville. As Ross says, the "fast conveyor belt" that now takes cardiac patients to the angioplasty room may be slowed by using tPA first. But clinical studies indicate that most tPA-treated patients still will eventually need angioplasty or bypass surgery, says Eric J. Topol of the University of Michigan in Ann Arbor.