The role of cholesterol in heart health

Research by a Michigan State University (MSU) cardiologist published in Clinical Cardiology (28:413–420, 2005) has shed new light on the role that cholesterol plays in causing heart attacks, strokes and other cardiovascular events in humans.

The work of George Abela, a professor in MSU’s Department of Medicine and chief of the department’s cardiology section, finds that cholesterol that has built up along the wall of an artery and crystallized from a liquid to a solid state can expand and then burst, sending material into the bloodstream.

It is this chain of events—the expansion of the liquid cholesterol as it crystallizes into a solid—that kick-starts the body’s natural clotting process that works against the body, essentially shutting down the artery.

“As the cholesterol crystallizes, two things can happen,” Abela said. “If it’s a big pool of cholesterol, it will expand and just tear the cap off the deposit in the arterial wall. Or the crystals—which are sharp, needle-like structures—pore their way through the membrane covering the cholesterol deposit, like nails through wood.”

It is the presence of the cholesterol crystals and other debris material released by the plaque rupture into the bloodstream that activates the clotting mechanism.

“What the clotting system is doing is reacting to an injury in the artery,” he said. “Once a rupture or erosion of the surface of the artery occurs, then the clotting system is activated to do its job.”

Abela compared the crystallization of the cholesterol to putting a plastic bottle of water into a freezer. Over time the water freezes and expands, pushing its way out of the bottle or breaking the bottle altogether.

What this work also means is that physicians and other health care providers now have another weapon in their arsenal against cardiovascular disease.

“So far, treatments have not been focused on this process,” Abela said. “Now we have a target to attack with the various approaches we have. In the past, we’ve treated the various stages that lead to this final stage, rather than preventing or treating this final stage of the condition.”

Until now, scientists had thought that inflammation of the wall had caused the breakdown of the cap that kept the cholesterol in the arterial plaque from rupturing. Abela said his findings don’t necessarily discount the inflammation theory, but rather add another dimension to it.

“As the crystals form, they dig their way through the wall of the artery, and that may be a trigger for the inflammation,” he said. “Inflammation is a normal mechanism, one that kicks in to repair the damage. That is why it is common to see inflammation at the site of these events.”

The research was conducted in Abela’s lab, research that he said was “as simple as science can get.”

Essentially, Abela and colleagues took varying amounts of cholesterol, reduced it to a liquid form, and then watched it expand as it solidified. In doing so, it tore through thin biological membranes.

“After the cholesterol crystallized, its volume was about 45 percent larger than what we started with,” he said. “And the entire process took all of about three minutes.”

Fish oil and arrhythmia

New research presented at the European Society of Cardiology Congress 2005 suggests that while patients with implanted cardioverter defibrillators were not helped by consumption of omega-3 (n-3) fatty acids, there was also no evidence of harm.

In the study, researchers with the Study on Omega-3 Fatty acid and ventricular Arrhythmia (SOFA) reported that omega-3 fatty acids contained in fish oil capsules reduced arrhythmias by 15% in patients with implanted cardioverter defibrillators, as measured by the firing of the devices, but that reduction was not statistically significant.

Ingeborg Brouwer, project manager at the Wageningen Center for Food Sciences in The Netherlands, said, “The SOFA trial does not indicate a strong beneficial effect of n-3 polyunsaturated fatty acids from fish on life-threatening cardiac arrhythmia.”

But she said that patients with a history of myocardial infarction (MI) “may still benefit from fish oil.” Brouwer added that in investigating subgroups in the trial she noticed that patients who had a previous MI appeared to show a trend toward a protective effect.

But even if fish oil didn’t help, she said the study confirmed that it doesn’t hurt either.

The researchers enrolled 546 patients and randomized 273 subjects to receive fish oil while the other 273 received a common cooking oil with no known cardiac effects, Brouwer said. After 12 months of monitoring, 30% of the patients taking fish oil had experienced a heart attack or stroke compared with 33% of those taking the placebo oil. That difference was not significant.

Obesity rates continue going up

Obesity rates continued to rise last year in the United States, according to a new report by Trust for America’s Health. Mississippi ranked as the heaviest state, Colorado as the least heavy, and rates stayed the same in Oregon, according to F as in Fat: How Obesity Policies are Failing in America, 2005. Over 25% of adults in 10 states are obese.

The ten states include Mississippi, Alabama, West Virginia, Louisiana, Tennessee, Texas, Michigan, Kentucky, Indiana and South Carolina. Seven of those 10 states are in the Southeastern U.S.

Some government experts took issue with the methods used to compile the ranking. The group averaged three years of data (2002–2004) from the Centers for Disease Control and Prevention’s Behavioral Risk Factor Surveillance System, a state-by-state telephone system in which participants report their own weight and height.

According to an official at the CDC, quoted in a USA Today newspaper article, the percentage of obese adults in each state could actually be several points higher or lower than the numbers indicate. Because the sample size varies from state to state, each one has a different margin of error, which means the states can’t be compared without giving that range.