MedicalXpress

Mini 'stress tests' could help condition heart to survive major attack

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People who experience brief periods of blocked blood flow may be better conditioned to survive a full-blown heart attack later, according to new research from the University of Cincinnati (UC).

In a five-year laboratory study, UC surgeon-scientist Karyn Butler, MD, found that when the heart experiences short periods of stress, either from reduced blood flow or high blood pressure, it activates a protective molecular pathway—known as JAK-STAT—that protects the heart muscle. The pathway, which is normally dormant in the heart, was originally identified in disease-fighting white blood cells as a mediator of infection and has recently been targeted for its role in heart health.

Butler says when the JAK-STAT pathway is active and functioning, it can help precondition and protect the heart from damage caused when blood flow is restored after a period of decreased flow, as occurs after a heart attack.

“These mini stress tests appear to push the heart muscle into an adaptive state where it gets used to how long-term stress feels,” Butler explains. “This preconditioning helps the heart muscle better tolerate longer episodes of compromised blood flow.”

Her team reports their findings in the January 2008 issue of the *American Journal of Physiology: Heart and Circulatory Physiology*.

A trauma/critical care surgeon at University Hospital in Cincinnati,

Butler wanted to determine how she could help patients with heart disease from high blood pressure tolerate cardiac ischemia, which occurs when vessels become narrowed or blocked and results in a dangerous reduction of blood flow to the heart.

To study the heart's response to restored blood flow after cardiac ischemia and in the presence of hypertension, Butler developed a hypertrophied (enlarged) animal heart model to mimic the conditions of heart enlargement and congestive heart failure in humans.

The enlarged heart model was then subjected to preconditioning—a series of short periods of blood flow blockage—to simulate what happens in humans with serious heart disease.

Butler found that these mini stress tests activated the dormant JAK-STAT pathway, and helped protect the muscle from injury when blood flowed back into the heart.

"The concept is similar to how we approach a new physical fitness regimen: incremental steps. You wouldn't try to condition yourself for a marathon by running 10 miles on your first day of training. You'd prepare yourself incrementally," explains Butler, an associate professor of surgery at UC and corresponding author of the study.

"The body appears to be doing the same thing when it comes to the heart. Patients often endure short periods of reduced blood flow before the blockage causes irreversible cardiac damage," she adds. "When the JAK-STAT pathway is activated, however, it appears to have a protective effect and may help the heart recover."

By revealing the underlying molecular mechanisms, Butler says, scientists may be able to develop drugs designed to selectively harness the protective benefits of the JAK-STAT pathway and help patients

avoid debilitating heart injuries.

Butler's next step is to compare the effects of the JAK-STAT pathway in normal hearts with diseased hearts similar to those of patients at higher risk for heart attack.

Source: University of Cincinnati