Risk of stroke associated with bypass surgery technique designed to prevent organ damage

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The standard practice of cooling and then rewarming a patient to prevent organ damage during cardiac bypass surgery may impair the body's mechanism that controls blood flow to the brain, potentially increasing the patient's risk of stroke, new research from Johns Hopkins suggests.

"For reasons we don't yet understand, it appears that during rewarming, an autoregulation mechanism that protects the brain from fluctuations in the body's blood pressure can malfunction," says Brijen Joshi, M.D., the study's leader and a research fellow in anesthesiology and critical care medicine at the Johns Hopkins University School of Medicine. "This could increase the chances that the brain won't get enough blood flow and oxygen and increase the risk of brain injury."

As many as five percent of cardiac bypass patients, the study finds, wake up from surgery with significant loss of controlled movement or speech caused by an interruption of blood flow to the brain — a stroke — but physicians have been unable to explain why. In a report on the observational study, published in the journal *Anesthesia & Analgesia*, the scientists suggest that the culprit could be a breakdown of this blood-flow regulation mechanism.

That mechanism seems to fail, they say, as doctors work to restore body temperature to its normal 36 degrees Celsius after cooling it to protect organs and facilitate heart bypass. If the autoregulation mechanism stops working, blood flow in the brain becomes entirely dependent upon blood pressure and can allow too much or too little blood to flow into the brain

— a dangerous result.

"You come in with a heart problem and now you can't move a limb or you can't speak and you have a neurological problem," says Joshi. "We have to figure out why this is happening."

As part of the study, Joshi and his colleagues monitored the blood pressure and brain blood flow of 127 patients undergoing standard, lengthy cardiac bypass surgery during which they spent two hours on a heart-lung machine that circulated their blood for them. Their bodies were cooled to below 34 degrees Celsius and then rewarmed. Eleven patients undergoing shorter bypass operations were kept at normal body temperature throughout and served as a control group.

After surgery, none of the control patients had experienced any neurological problems, while seven of the standard group had strokes and one experienced a transient ischemic attack, or TIA, a brief interruption of blood flow that's considered a harbinger for future stroke.

The study notes that while cooling and rewarming to protect organs during bypass surgery may impair autoregulation and increase the risk of stroke, there is little evidence that this practice is necessary.

Joshi and his colleagues say more research is necessary into the precise causes of the malfunction in the brain's blood-flow regulation mechanism. Currently, there is no good monitor to alert doctors in real time that blood flow in the brain is too low or too high, says Charles W. Hogue Jr., M.D., associate professor of anesthesiology and critical care medicine at the Johns Hopkins University School of Medicine and the study's principal investigator.

"We measure the heart, blood pressure, kidney function and more during

surgery," Hogue says. "But there's a huge need for a better monitor for the brain."

To that end, the team has been developing a monitoring device that, during bypass surgery, would measure blood flow to the brain using near infrared spectroscopy, along with software that tracks changes in individual patients as they happen. When the body gets to the point where it isn't properly regulating blood flow in the brain, doctors don't know it in real time. If a monitoring device could alert doctors that blood flow to the brain had declined, they could quickly adjust blood pressure, restoring adequate flow and potentially avoid a stroke.

"Once we find the point at which this mechanism fails, we might be able to keep blood pressure above that threshold and prevent brain injury," Joshi says.

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