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NEWS

RSNA Press Release

Caffeine May Affect Functional MRI Findings

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OAK BROOK, Ill. - Caffeine's effects need to be considered in functional magnetic resonance imaging (fMRI) studies of blood circulation in the brain, according to a study appearing in the April issue of the journal *Radiology*.

The study, from Wake Forest University School of Medicine in Winston-Salem, N.C., confirmed that a dose of caffeine equivalent to two or three cups of coffee can constrict the blood vessels in the brain and cause a reduction in cerebral blood flow. It also found that heavy caffeine users had more blood flow to the brain when they were in a withdrawal state, indicating a direct correlation between blood flow measurements and the amount of regular caffeine intake.

"The more caffeine you drink on a regular basis, the higher your cerebral blood flow will be when you do not consume caffeine," said lead author Aaron S. Field, M.D., Ph.D., now assistant professor of radiology at the University of Wisconsin in Madison.

Functional MR images depict areas of the brain that are activated in response to a cognitive or motor task or a visual or auditory stimulus. The fMRI scan can be designed to emphasize different features of brain anatomy and physiology, which is especially useful for those at risk for stroke and for evaluation of brain tumors prior to surgery.

"When studying cerebral perfusion, or blood flow to the brain, it is best to have patients consume their regular daily amount of caffeine before imaging," Dr. Field said. "Our research showed that the brain adapts to the level of caffeine typically consumed and adjusts cerebral blood flow accordingly. Simply telling people not to drink caffeinated beverages before fMRI is not a feasible solution, because the withdrawal state will skew results."

Previous research has shown caffeine consumption diminishes blood flow to the brain. For this study, the researchers used quantitative perfusion MRI (a type of functional MRI) to evaluate the effects of caffeine consumption and withdrawal on cerebral blood flow in 20 healthy adults. According to the study, the daily per-person caffeine consumption in the United States is approximately 238 milligrams, or a little more than two cups of coffee. Half of the study group was categorized as "low" caffeine consumption (average of 41 mg of caffeine daily), and the other half as "high" caffeine consumption (average of 648 mg of

caffeine daily).

The patients were scanned with perfusion imaging at approximately the same time of day on two different days. Patients were randomly selected to receive a placebo on one day and a 250 mg dose of caffeine on the other day approximately 90 minutes before the scan. To induce caffeine withdrawal, patients abstained from caffeine for at least 30 hours before the test.

The researchers found that caffeine reduced cerebral blood flow in gray matter areas by approximately 23 percent in all patients. The cerebral blood flow was reduced in the gray matter in the front of the brain by 26 percent in heavy caffeine users and 19 percent in the light caffeine users. During withdrawal, cerebral blood flow in heavy caffeine users exceeded that of the light users by more than 30 percent.

"Dramatic differences in cerebral blood flow measurement can be seen from one day to the next based on a single cup of coffee," Dr. Field explained. "This shows researchers need to control for caffeine effects."

Dr. Field noted that the ramifications of this study apply only to very specific types of MR scans that are not routinely utilized. "The average person will not need to worry about caffeine consumption when having an MRI," he said.

The researchers suggest that future studies might address the potential effects of tobacco, alcohol and over-the-counter and prescription medications on cerebral blood flow and fMRI.

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Radiology is a monthly scientific journal devoted to clinical radiology and allied sciences. The journal is edited by Anthony V. Proto, M.D., School of Medicine, Virginia Commonwealth University, Richmond, Virginia. Radiology is owned and published by the Radiological Society of North America, Inc. (http://radiology.rsna.org)

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"Dietary Caffeine Consumption and Withdrawal: Confounding Variables in Quantitative Cerebral Perfusion Studies." Collaborating with Dr. Field on this study were Paul J. Laurienti, M.D., Ph.D.; Yi-Fen Yen, Ph.D.; Jonathan H. Burdette, M.D.; and Dixon M. Moody, M.D., from Wake Forest University School of Medicine in Winston-Salem, N.C.