

Researchers make essential imaging tests safer for people at risk of acute kidney injury

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Dan Muruve, left, and his team, including postdoctoral fellow Arthur Lau, have discovered why contrast dyes in diagnostic tests can cause harm to kidneys. Credit: Riley Brandt, University of Calgary

Every year, millions of people undergo medical tests and procedures, such as coronary angiography, which use intravascular contrast dyes. "For the majority of patients, these are safe and necessary procedures. However, about eight per cent of those people experience the complication of acute kidney injury (AKI)," says Dr. Dan Muruve, MD, a kidney specialist and member of the Snyder Institute for Chronic

Diseases at the Cumming School of Medicine (CSM) at the University of Calgary.

"My kidney function was at 13 per cent when I was diagnosed with [acute kidney injury](#). I easily could have ended up on dialysis," says Sam Hannon, who underwent two angioplasty procedures after having a heart attack. "Anything that can be done to make all procedures safer for patients is great news. This research is vital."

"People like Sam, who require complex procedures with large contrast dye volumes, or those with pre-existing diabetes or chronic kidney disease, have a much higher risk of acute kidney [injury](#) following these procedures," says Dr. Matthew James, MD, Ph.D., also a kidney specialist and a member of the CSM's Libin Cardiovascular Institute of Alberta and the O'Brien Institute for Public Health. "We have effective protocols to minimize that risk, but occasionally, in some high-risk patients, these measures are insufficient to completely prevent kidney damage. This research has shown how the kidney responds to the contrast dye, and reveals new ways we could better protect the kidneys."

James and Muruve are collaborators on a Canadian Institutes of Health Research (CIHR) team focused on inflammation and kidney disease. In a recent study published in the *Journal of Clinical Investigation*, the team shows for the first time how contrast dye injures the kidney. Using specialized high-powered microscopes, the University of Calgary scientists were able to map out in real time the dye's progression through the kidney. The study, using mice, showed that in a fully hydrated kidney the dye flushes through, but in a kidney with low hydration the kidney absorbs the dye, causing inflammation that can lead to serious damage. The new knowledge from this study is already translating to work with people.

"We did a small study testing human urine after contrast dye exposure.

We saw the same markers in people as we do in mice. These results can help us add to the steps we currently emphasize to reduce the amount of contrast dye used and to hydrate the patient," says James. "Despite this, some patients with kidney disease currently avoid these medical tests because of the concern about possible injury to their kidneys. This research could help make these tests even safer for them."

The UCalgary research team is already working on a therapeutic intervention to help those patients who cannot be hydrated easily. "For some patients with weak hearts, extra fluids are not recommended," says Muruve. "Through this research we've discovered a drug that stops the kidney from absorbing the dye to prevent possible injury. We've tested a medication that is showing promising results. The next step is to translate these findings into clinical trials." Muruve has since founded a spinoff company to design new medications for AKI.

This research is supported by Canadian Institutes of Health Research (CIHR) and The Kidney Foundation of Canada.

"These findings are a great step forward for people living with kidney failure caused by injury," says Elisabeth Fowler, national director of research, The Kidney Foundation of Canada. "Our goal in funding research is to work toward finding a cure, and to help translate fundamental discoveries from the lab bench into clinics and hospitals to ease the burden of kidney disease. We look forward to upcoming results of this promising work."

"This study is important because it increases our understanding of how we might intervene to prevent acute renal injury or interrupt the progression of acute [kidney](#) injury to [chronic kidney disease](#) thereby reducing the burden of [kidney disease](#) among Canadians. As a practising nephrologist, I look forward to learning more about how this research will be applied in clinical settings," says Dr. Norman Rosenblum, MD,

scientific director of the CIHR Institute of Nutrition, Metabolism and Diabetes.

More information: Arthur Lau et al. Renal immune surveillance and dipeptidase-1 contribute to contrast-induced acute kidney injury, *Journal of Clinical Investigation* (2018). [DOI: 10.1172/JCI96640](https://doi.org/10.1172/JCI96640)

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