Clinical research to improve surgery outcomes

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Research by Victoria PhD student Jennifer Williams could lead to better recovery outcomes for surgery patients.

The Clinical Research student is investigating the potential for a simple pre-surgery technique that could reduce organ damage following surgery.

"One of the major problems associated with recovering from surgery is the tissue damage to organs caused when blood flow, and therefore oxygen, is temporarily restricted.

"For example, during a cardiac bypass or valve operation, the circulation of blood through a patient's heart is suspended and rerouted through a machine. When blood flow is restored it can damage the heart muscle, leading to inflammation. This inflammation is often widespread, causing damage to the kidneys and lungs, and can even be fatal."

Jennifer's research aims to help solve this problem by revealing new information about a simple technique known as Remote Ischaemic Preconditioning (RIPC).

This technique was discovered in 1986, when researchers observed that the body could be 'prepared' for a lack of oxygen by temporarily restricting blood flow to a limb—usually an arm—immediately before surgery. The subsequent tissue damage was shown to be significantly reduced.

Jennifer's primary supervisor is Dr Anne La Flamme, an associate professor in Cell and Immunobiology research in Victoria's School of Biological Sciences.

Anne, who also leads multiple sclerosis research at the Malaghan Institute of Medical Research, says the theory behind RIPC is that the brief restriction of oxygen 'activates' the body, preparing it for more substantial trauma.

Clinical trials into the effectiveness of RIPC began in 2000, but have so far produced mixed results.

"One of the main reasons for this ambiguity is that we still don't fully understand all the pathways involved," Jennifer says.

Jennifer became interested in RIPC during her Honours year, when she assisted Dr Paul Young at Wellington Hospital to conduct a trial with highrisk cardiac surgery patients.

To shed new light on the technique, Jennifer is now designing and conducting clinical trials using healthy volunteers.

"The idea behind using healthy volunteers is that surgery patients, especially cardiac patients, often take medication or have additional health conditions that interfere with accurate testing.

"It's quite straightforward: we inflate a bloodpressure cuff on the upper arm of a patient for five minutes, release it for five minutes and repeat two more times."

Jennifer then analyses cells from the volunteer's blood samples taken before and after RIPC.

The subsequent changes in blood cells are leading her to believe that the body's immune response is key to understanding RIPC.

Jennifer says two areas of research interest are the white blood cells called neutrophils, thought to be largely responsible for damaging organ tissue following surgery; and cytokines, the 'hormones of the immune system', which play a fundamentalrole in cell interaction.

"One consistent effect we've observed is that preconditioning seems to reduce the activation of neutrophils, and Jennifer's study is the first to show this reduction occurring very quickly after preconditioning—within the first four hours," says Anne.

Jennifer is planning a further trial using healthy volunteers to discover whether a stronger response from the immune system occurs when RIPC is applied 24 hours before testing the blood.

"This may give the body even more time to respond, and be even better prepared for surgery."

Jennifer says it's exciting working in an area of medical research where so little is known, and she believes the technique could eventually be applied more widely.

"If we can improve outcomes for surgery patients with such a simple technique, then that would be incredible."

Provided by Victoria University