Unblocking arteries with maths

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University of Melbourne researchers have combined mathematical modelling, supercomputing and laser imaging technology to assess the severity of artery blockages without having to insert a physical separate pressure wire to assess blood pressure loss around a blockage.

The modelling could open the way to preventing blockages in the first place by more accurately identifying whether part of an artery is prone to fat and cholesterol build up.

University of Melbourne Professor Peter Barlis, a cardiologist and academic researcher at St Vincent's Hospital Melbourne and the Northern Hospitals, said: "Arteries are very complicated geometrically, but if we can model how that complexity affects fluid flow and turbulence within the artery we can then identify places where the fluid is slowing and is therefore at higher risk of developing blockages from deposited fats, cholesterol and calcium.

"That could allow us to predict where patients may develop problems in the future and intervene early with perhaps medication or new therapies that can prevent future deterioration and complications," Professor Barlis said.

Standard angiograms – x-rays looking at coronary arteries for narrowing or blockages – produce 2-D images with little or no information about arterial surface variations. They may reveal blockages, but not whether they are serious enough to warrant a stent.

"In those cases, we have to rely on measuring the blood flow, and that generally means using another invasive procedure and insert a pressure wire," Professor Barlis said.

Professor Barlis worked with University of Melbourne engineers Professor Andrew Ooi, Dr Eric Poon and Dr Vikas Thondapu to combine high resolution laser data from catheter-mounted optical coherence tomography (OCT) with angiogram data to successfully model blood flow in a section of an artery.

Although the new modelling method requires access to a supercomputer, the researchers believe computing power advances will see a clinic-based platform able to crunch the data within the near future.

Provided by University of Melbourne