Implantable device to beat high blood pressure

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Image: Imperial College London

An implantable device that reduces blood pressure by sending electrical signals to the brain has been created by a group of researchers in Germany.

The device has successfully reduced the blood pressure in rats by 40 per cent without any major side effects, and could offer hope for a significant proportion of patients worldwide who do not respond to existing medical treatment for the condition.

The first results have been published today, 9 May, in IOP Publishing's *Journal of Neural Engineering*.

The device consists of 24 individual electrodes that are integrated into a

micro-machined cuff. It is designed to wrap around the vagal nerve, which extends from the brainstem to the thorax and abdomen, supplying and stimulating various major organs including the heart and major blood vessels.

The device works by picking up signals from specific sensors, known as baroreceptors, which are activated when blood vessels stretch. Some baroreceptors are grouped together in concentrated areas in the aortic arch and report their information to the brainstem via fibres in the vagal nerve. These baroreceptors function to control short-term fluctuations in blood pressure.

The device has been designed to identify only those fibres that influence the blood pressure and avoid those that are responsible for heart rate, the power of heart beat, ventilation and other vital functions.

In their study, the researchers, from the University of Freiburg, tested a prototype device on five male rats. The device was 2 cm long, with a 0.8 mm diameter, and delivered 40 pulses per second to the fibres of the baroreceptors in the vagal nerve.

The researchers experimented on various areas of the vagal nerve, exploring different stimulation sites around the nerve with different frequencies, amplitudes and durations of stimulation. Using the appropriate parameters, the researchers showed that the blood pressure could be easily reduced to 60 per cent of its original value in a wide range of stimulation frequencies and pulse widths.

No major side effects, such as a significant decrease in heart rate or breathing rate, occurred when the electrode sites closest to the baroreceptor fibres were chosen for stimulation.

Lead author of the research, Dr Dennis Plachta, said: "Our proof-of-

concept interface has shown that it is possible to use the left vagal nerve to reduce blood pressure without any adverse side effects, which is important for a wide variety of potential treatments that could utilise nerve stimulation without actually penetrating the nerve.

"As the device will require surgery, it is not intended to be the first port of call for treatment and will come into play when patients, for whatever reasons, are resistant to medication. Nevertheless, the long-term goal is to provide 'treatment-on-demand' for the patient, whereby the implantable device uses an intelligent circuit to record the activity of the patient, for instance when they are doing exercise, and adjust the blood pressure accordingly.

"We will now look to develop the implantable device further and investigate whether it interferes with existing medication, and ultimately test it on larger animals such as pigs and sheep."

More information: 'Blood pressure control with selective vagal nerve stimulation and minimal side effects' D T T Plachta et al 2014 *J. Neural Eng.* 11 036011. iopscience.iop.org/1741-2552/11/3/036011

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