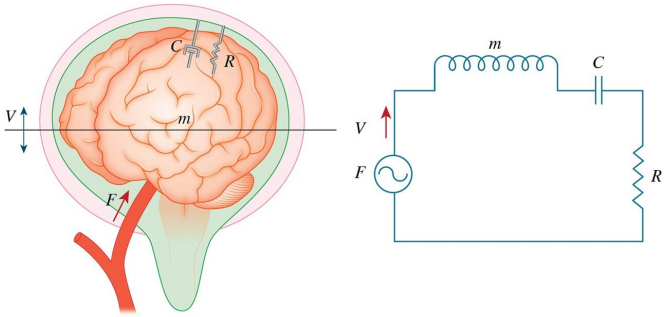
Non-invasive method to predict brain pressure

1 April 2020



The theoretical analysis of the resonance phenomenon in the skull. Credit: Copyright 2020, Springer Nature Limited

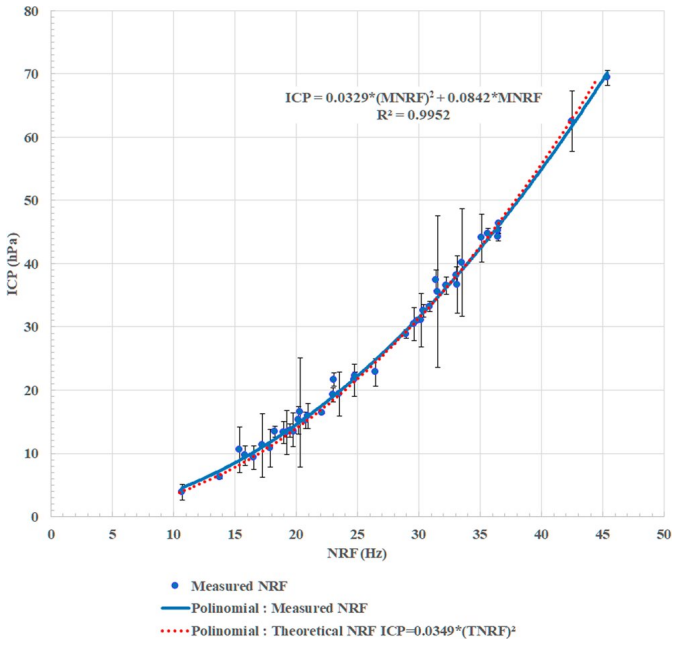
The only way to accurately measure pressure inside the skull is to insert a catheter or sensor inside. However, this is invasive and techniques with less risk are desired. Intracranial pressure (ICP) needs to be correctly accounted for in a variety of medical situations including neurosurgery, neurology and emergency medicine.

Doctors at the Shinshu University School of Medicine discovered a non-invasive way to predict ICP by the brain's natural resonance frequency (NRF). This is because the NRF of the brain was found to be only dependent on the ICP value. The NRF is what frequencies an object will vibrate at when a force is applied.

The NRF of the brain can be measured from the movement of the eardrum and external ear pressure waveform. The NRF of an object is based on its mass, elasticity and other factors. The NRF of the brain is dependent on brain weight, which on average is 1.4kg and the cerebral volumetric compliance, or how much give the skull has.

There are many factors that modulate the ICP value, such as the respiratory rhythm, which changes as much as 55% with inhalation and exhalation. The pressure inside the chest effects the pressure inside the vessels taking blood up to the brain which then effects the ICP.

There was a strong correlation (R =0.99999) between the ICP value and NRF of the brain, which means that ICP can be predicted from the NRF.



A graph of the relationship between the ICP value and the NRF of the brain. Credit: Copyright 2020, Springer Nature Limited

More data needs to be collected for high ICP values and small brain weights.

All experiments were conducted in accordance with relevant guidelines, regulations and informed consent.

More information: Tetsuya Goto et al, Natural resonance frequency of the brain depends on only intracranial pressure: clinical research, *Scientific Reports* (2020). DOI: 10.1038/s41598-020-59376-7

Provided by Shinshu University