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4D-PIXELFLUX Volume flow measurements of cerebral perfusion as a tool to quantify cerebral venous congestion

T. Scholbach

Praxis für funktionelle Ultraschalldiagnostik, Leipzig, Deutschland

Background

Brain perfusion nowadays is often evaluated by its arterial influx. Its venous drainage however is much more difficult to explore and thus often neglected. As a result, important conditions such as cerebral and spinal congestion are not taken into account and symptoms like non-epileptic seizures, cranial nerve dysfunctions or migraines remain poorly understood.

The complex changes of the momentarily shape and flow velocities and velocity distribution of the internal jugular vein escape simple Doppler measurements and demand a completely new approach. The real-time virtual horizontal imaging plane of matrix transducers offers the possibility of true pixelwise flow volume measurements even in the puzzling ever changing internal jugular vein.

Patients and methods

The method of 4D-PIXELFLUX volume flow measurements is explained and demonstrated in case presentations of patients with a variety of so far unexplained symptoms

Results

4D-PIXELFLUX volume flow measurements deliver separate bilateral flow volumes of carotid and vertebral arteries and internal jugular and vertebral veins. The overall flow volume difference is attributed to the spinal epidural plexus. This way increased intracranial pressure can be assumed when the cervical veins drain less volume than delivered by the cervical arteries. The epidural flow volume and direction can be calculated offering insights in spinal collateral flow towards the skull in abdominal and pelvic compression syndromes. Moreover, the hemodynamic effect of jugular vein compressions can be clarified. This is important for indicating an operation since pressure gradients and diameter reduction may be misleading.

Conclusions

4D-PIXELFLUX volume flow measurements of brain supplying cervical vessels may close a gap in the understanding and treatment planning of central nervous functional diseases as fluctuating intracranial pressure with related symptoms as headache, migraines, cranial nerve dysfunctions and non-epileptic seizures.

Also the cerebral impact of remote disorders onto the brain mediated by spinal congestion can be evaluated.

Autorenschaft

Erst-Autor:in:	Thomas Scholbach
Präsentiert von:	Thomas Scholbach

Eingereicht von:

Thomas Scholbach