



Webinar in Brain Physics with Cambridge

3rd – 23rd June 2020, daily, 1:00 pm UK time

Theory and Practice Robot-assisted brain monitoring



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Key Content:

CSF - cerebrospinal fluid (CSF) circulation
Autoregulation of cerebral blood flow
ICP - Intracranial pressure in non-invasive way
Monitoring of cerebral blood flow
TBI
Multimodality

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3rd of June 13:00

Lecture 1 Physics of cerebrospinal fluid (CSF) circulation in brain: Sites and mechanisms of CSF production, circulation and reabsorption. Physiological and modelling description.

Lecture 2 Cerebral blood flow and metabolism: Physiology of brain blood inflow, circulation and venous outflow. Architecture of cerebrovascular tree. Basic physics of blood flow

4th of June 13:00

Lecture 3 Autoregulation of cerebral blood flow. Mechanisms of regulation: myogenic, metabolic and chemical. Structure of arterial walls, role of endothelium. Macroscopic observations: Lassen's curve. Dynamic and static autoregulation. Clinical examples

Lecture 4 Intracranial pressure: measurement and monitoring: CSF pressure as a 'golden standard'. Intraparenchymal pressure. Sensors, drifts, errors and monitoring techniques

5th of June 13:00

Lecture 5 Monitoring of cerebral blood flow: Various techniques: transcranial Doppler, laser Doppler flowmetry, thermal dilution, Near Infrared Spectroscopy

Lecture 6 ICP is more than the number. Waves and fluctuations of ICP, interpretation. Slow and respiratory waves. Spectral components of ICP

8th of June 13:00

Lecture 7 Cerebral perfusion pressure: Definitions, source of instability. Implication on management protocols. What happens when CPP is too low, and when it is too high?

Lecture 8 Waveform analysis of intracranial pressure: Pulse analysis, high frequency centroids, morphological methods?

9th of June 13:00

Lecture 9 Pressure reactivity: Relationship between ICP and arterial blood pressure (ABP). Pressure-reactivity index, computational methods. Clinical examples. Optimization of cerebral perfusion pressure: Relationship between Pressure Reactivity and CPP. Does 'optimal CPP' exist always? Implications on management.

Lecture 10 Pressure-volume compensatory reserve: Pressure-Volume Index, RAP index. Applications in hydrocephalus and head injury.

10th of June 13:00

Lecture 11 Traumatic brain injury. Links between ICP, CPP, PRx monitoring and outcome after TBI. Does CT picture really help? Critical levels of CPP, ICP and PRx

Lecture 12 Cambridge, UK: short and long walks, Winnie the Pooh and history of Cam River punting

11th of June 13:00

Lecture 13 Modelling of CSF compensation: Mathematical model (Marmarou).

Lecture 14 Volume-pressure infusion tests: Typical patterns of infusion studies in different forms of CSF circulatory disorders.

12th of June 13:00

Lecture 15 Resistance to CSF outflow: What it is and what it isn't. Use of the resistance to optimize management of hydrocephalus. Who needs a shunt?

Lecture 16 CSF shunts for treatment of hydrocephalus – construction and engineering of CSF hydrocephalus shunts: from historical to contemporary designs. Cambridge Shunt Evaluation Laboratory. Shunt testing in-vivo: Use of infusion tests to assess shunt functioning after implantation: patterns of underdrainage and overdrainage. Slit ventricles syndrome. Overnight ICP monitoring

15th of June 13:00

Lecture 17 Transcranial Doppler (TCD) Ultrasonography: vasospasm . Transcranial Doppler Pulsatility Index and other useful measures of blood transport in great cerebral vessels. Is Pulsatility index related to ICP? Is it a measure of cerebrovascular resistance?

Lecture 18 Use of Transcranial Doppler for monitoring of cerebral autoregulation.

16th of June 13:00

Lecture 19 Compartmental compliances of brain: assessment of cerebral arterial compliance and lumped compliance of CSF and venous pool. Monitoring of Monro-Kelly doctrine: Mutual relationship between brain compartmental compliance as a marker when intracranial hypertension becomes 'refractory'

Lecture 20 Time constant of cerebrovascular system: applications in Common Carotid Artery Stenotic Disease and cerebral vasospasm following Subarachnoid Hemorrhage. Time constant versus ABP and ICP- experimental design

17th of June 13:00

Lecture 21 Cerebrovascular impedance: Linear modelling of basal cerebral vessels. Is pulsation of blood transport greater than pulsation of arterial blood pressure? Why? Critical closing pressure (CrCP)- theoretical concept versus clinical implications. Use of CrCP to measure 'real CPP' or non-invasive estimate of ICP

Lecture 22 Non-invasive methods for ICP monitoring: transcranial Doppler flowmetry and other useful methods.

18th of June 13:00

Lecture 23 Brain Biochemistry. Monitoring of cerebral tissue oxygenation: SJVO₂, Licox, and NIRS. Cerebral microdialysis.

Lecture 24 Alternative indices of cerebrovascular reactivity: use of Near Infrared Spectroscopy, tissue oxygenation and others

19th of June 13:00

Lecture 25 Modelling of cerebral blood flow: Integration of cerebral blood flow into Marmarou's model

Lecture 26 Experimental cerebrovascular dynamics: Projects, instrumentation, models.

25th of June 13:00

Lecture 27 Software for brain monitoring: ICM+

Lecture 28 Recent techniques for brain signal analysis. Summary

26th of June 13:00

The Quiz