

TCD in Anaesthesiology

Background:

TCD has often been used to evaluate the impact of narcotics on cerebral autoregulation. This was related to general research reasons and is not relevant for daily monitoring during anaesthesia. It seems to be unclear, if assessment of cerebral autoregulations is worthwhile in patients undergoing surgery who are suffering from neurological diseases.

Literature:

Transcranial Doppler to assess sepsis-associated encephalopathy in critically ill patients.

Author	<u>Pierrakos C1, Attou R1, Decorte L2, Kolyviras A1, Malinverni S1, Gottignies P1, Devriendt J1, De Bels D1.</u>
Content/Summary Abstract	<p>BACKGROUND: Transcranial Doppler can detect cerebral perfusion alteration in septic patients. We correlate static Transcranial Doppler findings with clinical signs of sepsis-associated encephalopathy.</p> <p>METHODS: Forty septic patients were examined with Transcranial Doppler on the first and third day of sepsis diagnosis. The pulsatility index (PI) and cerebral blood flow index (CBFi) were calculated by blood velocity in the middle cerebral artery (cm/sec). Patients underwent a daily cognitive assessment with the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) test.</p> <p>RESULTS: Twenty-one patients (55%) were found to present confusion. The majority of the patients presented a PI > 1.1 (76%). PI on the first day (but not the third day) could predict a positive CAM-ICU test in septic patients (PI cut-off: 1.3, AUC: 0.905, p < 0.01, sensitivity: 95%, specificity: 88%, AUC: 0.618, p = 0.24). Multivariable analysis showed that PI on the first day is related to a positive CAM-ICU test independent of age and APACHE II score (OR: 5.6, 95% CI: 1.1-29, p = 0.03). A decrease of the PI on the third day was observed in the group that presented initially high PI (>1.3) (2.2 ± 0.71 vs. 1.81 ± 0.64; p = 0.02). On the other hand, an increase in PI was observed in the other patients (1.01 ± 0.15 vs. 1.58 ± 0.57; p < 0.01). On only the first day, the mean blood velocity in the middle cerebral artery and CBFi were found to be lower in those patients with a high initial PI (36 ± 21 vs. 62 ± 28 cm/sec; p < 0.01, 328 ± 101 vs. 581 ± 108; p < 0.01, respectively).</p>
Comment	Cerebral perfusion disturbance observed with Transcranial Doppler could explain clinical symptoms of sepsis-associated encephalopathy.
Doppler-device	Not known

Quantification	TCD is an efficient method to evaluate cerebral perfusion in critically ill, septic patients.
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Cerebral hypoperfusion during pediatric cardiac surgery detected by combined bispectral index monitoring and transcranial Doppler ultrasonography.

Author	(Toyama u. a., 2011)
Content/Summary	see title
Comment	Case report
Doppler-device	Not known
Quantification	TCD and BIS are useful to detect cerebral hypoperfusion

Preoperative assessment and preparation of patients with diseases affecting the central nervous system.

Author	(Milaković u. a., 2011)
Content/Summary	Regardless of the reason for surgery, coexisting diseases of brain often have important implications when selecting anesthetic drugs, procedures and monitoring techniques
Comment	Review
Doppler-device	None
Quantification	Intraoperative cerebral autoregulation monitoring is an important consideration for the patients with coexisting neurological disease. Transcranial Doppler based static autoregulation measurements appears to be the most robust bedside method for this purpose.

Use of transcranial Doppler ultrasonography and jugular oximetry to optimize hemodynamics during pediatric posterior fossa craniotomy.

Author	(Sharma u. a., 2010)
Content/Summary	Transcranial-Doppler (TCD) ultrasonography-guided stepwise increase in mean arterial pressure led to a linear increase in the mean flow velocity of the middle cerebral artery and S _{ij} O ₂ to desirable values.
Comment	Case report
Doppler-device	Not known
Quantification	Intraoperative S _{ij} O ₂ monitoring and TCD ultrasonography may be utilized together to individualize hemodynamic targets and ventilation parameters and maintain adequate cerebral oxygenation during paediatric craniotomies.

Anesthesia for patients with neurologic disease.

Author	(Greene, 2010)
Content/Summary	
Comment	Review
Doppler-device	Not known
Quantification	Summary of autoregulation affecting matters in anaesthesia

Monitoring of brain function in anesthesia and intensive care.

Author	(Grocott u. a., 2010)
Content/Summary	
Comment	Review
Doppler-device	None
Quantification	However, integrating the information from several monitors may provide a means by which to guide therapeutic intervention aimed at optimizing perioperative outcomes.

High-intensity transient signals during laparoscopic surgery in children.

Author	(Schramm u. a., 2010)
Content/Summary	In 14 children (70%), HITS were detected during baseline and pneumoperitoneum. Three additional children (15%) developed HITS during pneumoperitoneum only and another three children (15%) presented no HITS during the investigation period. MAP and cerebral blood flow velocity increased with pneumoperitoneum.
Comment	Twenty children were monitored during laparoscopic surgery.
Doppler-device	DWL
Quantification	HITS are present in 70% of paediatric surgical patients under balanced anaesthesia before surgical interventions. Pneumoperitoneum further increased the occurrence of HITS.

Cerebral autoregulation and anesthesia.

Author	(Dagal und Lam, 2009)
Content/Summary	Intravenous anesthesia, such as combination of propofol and remifentanyl, provides best preservation of autoregulation. Among inhaled agents sevoflurane appears to preserve autoregulation at all doses, whereas with other agents autoregulation is impaired in a dose-related manner. The potential clinical applications include (1) Optimization of blood pressure management in the patients with traumatic brain injury undergoing non neurosurgical procedures. (2) Goal-directed blood pressure support in the patients with critical carotid artery stenosis. (3) Perioperative management of patients undergoing carotid endarterectomy. (4) Blood pressure management in uncontrolled hypertensive patients.
Comment	Review
Doppler-device	Not known
Quantification	Intraoperative cerebral autoregulation monitoring is an important consideration for the patients with neurologic disease. Transcranial Doppler based static autoregulation measurements appears to be the most robust bedside method for this purpose.

Summary:

Integrating the information from several monitoring procedures may provide a means by which to guide therapeutic intervention aimed at optimizing perioperative outcomes, especially in patients suffering from neurological diseases.

Based on recent literature it cannot be stated if monitoring of cerebral autoregulation by TCD results in essential benefit.

Experts:

Sharma
Werner

Literature

Dagal A, Lam AM. Cerebral autoregulation and anesthesia. *Curr Opin Anaesthesiol* 2009; 22: 547-552.[zitiert 2011 Nov 29]

Greene SA. Anesthesia for patients with neurologic disease. *Top Companion Anim Med* 2010; 25: 83-86.[zitiert 2012 Jan 4]

Grocott HP, Davie S, Fedorow C. Monitoring of brain function in anesthesia and intensive care. *Curr Opin Anaesthesiol* 2010; 23: 759-764.[zitiert 2012 Jan 4]

Milaković B, Dimitrijević I, Malenković V, Marković D, Pantić-Palibrk V, Gvozdenović L. Preoperative assessment and preparation of patients with diseases affecting the central nervous system. *Acta Chir Iugosl* 2011; 58: 83-90.[zitiert 2011 Okt 29]

Schramm P, Engelhard K, Scherhag A, Schier F, Werner C. High-intensity transient signals during laparoscopic surgery in children. *Br J Anaesth* 2010; 104: 224-227.[zitiert 2011 Dez 9]

Sharma D, Ellenbogen RG, Vavilala MS. Use of transcranial Doppler ultrasonography and jugular oximetry to optimize hemodynamics during pediatric posterior fossa craniotomy. *J Clin Neurosci* 2010; 17: 1583-1584.[zitiert 2011 Okt 31]

Toyama S, Sakai H, Ito S, Suzuki Y, Kondo Y. Cerebral hypoperfusion during pediatric cardiac surgery detected by combined bispectral index monitoring and transcranial doppler ultrasonography. *J Clin Anesth* 2011; 23: 498-501.[zitiert 2011 Okt 29]

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