

## SPECIFICITIES IN NEUROANAESTHESIA

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It is essential to know CNS physiology, especially the relationships between cerebral blood flow (CBF), cerebral autoregulation, cerebral perfusion pressure (CPP), intracranial pressure (ICP), and intracranial volume (ICV). CPP is the difference between the arterial blood pressure (ABP) and the ICP. Cerebral autoregulation is influenced by changes in carbondioxide, oxygenation, cerebral disease or trauma and anaesthesia.

The brain should be kept in a relaxed state perioperatively (“brain relaxation”) to obtain good surgical conditions. Close collaboration with the neurosurgeon is essential. Several factors may influence brain relaxation. Keeping close attention to stable haemodynamics as to ABP, CPP and CBF, fluid balance, osmotic pressure (electrolyte disturbances), and to ventilation and oxygenation at all times is essential. A hypervolemic status is probably best avoided, euvolemia being the goal.

As to choice of vasopressor, there are no large convincing studies showing which should be preferred (phenylephrine, norepinephrine or dopamine) when considering CPP, CBF or cerebral oxygenation, although other patient factors (eg cardiovascular disease) might influence choice.

Isotonic crystalloid solutions are probably best for intravenous fluid therapy, use of colloids being controversial. Still, there is a lack of large studies in elective neurosurgical procedures to confirm this, with such recommendations being based on studies in traumatic brain injury (TBI) or subarachnoidal haemorrhage (SAH) patients.

As to hyperosmolar therapy both mannitol and hypertonic saline (HTS) may be used in order to improve brain relaxation. A recent meta-analysis showed a slight advantage to HTS. Robust outcome measures were absent, however, with further studies needed to evaluate any differences.

We often rely on indirect monitoring of CBF, basing our anaesthesia approach on estimations of the CPP from ABP measurements (mean arterial pressure, MAP) when there is no ICP measurement available. With an intraventricular drain or intraparenchymal probe in place, the ICP may be measured, and with direct monitoring of the CPP. Direct monitoring of CBF can be obtained by transcranial Doppler (TCD). Direct measurement of cerebral tissue oxygenation is possible and of value as to short time outcome in cerebrovascular surgery. Several methods from intensive care multimodal monitoring of severe TBI- or SAH- patients have been applied perioperatively. These methods are often hampered by cumbersome setups, however, not being practical in surgical settings.

As to short time outcome there are no conclusive studies as to which type of anaesthesia should be preferred (intravenous or inhalational), although a high MAC of volatile anaesthetics might cause cerebral vasodilation. So far, no perioperative pharmacological neuroprotective treatment have proved to be of value as to outcome.

Generally there is a lack of larger randomized controlled trials (RCTs) on how anaesthesia might affect long term clinical outcomes in neurosurgical patients, and multicenter studies are warranted.