Interventional neuroradiology- the specific challenges for anesthesiologist

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06AP05-5
Interventional neuroradiology- the specific challenges for anesthesiologist

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Background: There is still no consensus about the best anesthesia strategy for interventional neuroradiology. Choice between general anesthesia (GA) and conscious sedation (CS) remains in the hands of (neuro) anesthesiologist.
Clinical case-series: Over the last four years our neurointerventional center in Croatia continuously has grown and developed from low to high-volume. We present single center experience with more than one hundred procedures every year. During the last year there were 60 thrombectomies and 60 other cases. General endotracheal anesthesia is preferred method that we use, with target controlled infusion (TCI) technique with propofol and remifentanil, and rocuronium for intubation. Low dose of esmolol is used for smooth intubation (avoiding BP and ICP increase). Short acting drugs allows rapid neurological examination after procedure. Using this strategy, we avoid BP variability, movements are decreased, patients airway is secured and optimal control of carbon dioxide levels are achieved. Monitoring includes: ECG, invasive and non-invasive BP, SpO2, RR, EtCO2, BIS and hourly urinary output.
Discussion: In anesthetic management exists large variability so interventional neuroradiology is challenging for anesthesiologist. Anesthetic management for this patients is much more than anesthetic plan of sedation or GA. Strategies include an individualized approach to hemodynamic and respiratory parameters, intravascular fluids, coagulation control and neuroprotection that can be essential for a favorable outcome. "Time is brain" and dedicated team members are time saving. Taking into account patients, technical and clinical factors we found GA the most suitable for our patients.
Learning points: Crucial steps in establishment of interventional neuroradiology is creation of a competent neuroanaesthesiologist, who are able to provide care for these patients. Drugs fine titration, accurate BP and respiratory function monitoring, good plan in dealing with possible complication and close collaboration with neuroradiologist are milestones of favourable outcome. In view of that, anaesthesiologists contribution to this procedure is essential and the best anesthesia management is in partnership with the neuroradiologist.

06AP05-6
Familiar multiple paragangliomas - a case report

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Background: Paragangliomas represent one of the biggest challenges of anesthesia practice, particularly if they secrete catecholamines.
Case Report: ASA IV 38-year old male wih multiple paragangliomas -gene SDHD mutation- with hepatic and bone metastasis, under blood pressure control with phenoxybenzamine, amlodipine and bisoprolol.
He presented amaurosis and exoftalmy due to a periorbitary paraganglioma and was proposed for tumorectomy. Preoperatively, α and β blockers were maintained. The patient was induced with midazolam, remifentanil, propofol and rocuronium, along with lidocaine, labetalol and phentolamine to block hemodynamic response to intubation. He was maintained on a target-controlled total intravenous anesthesia with remifentanil and propofol. Blood pressure was controlled with labetalol and phentolamine infusions (SBP 120-220 mmHg, DBP 50-90 mmHg, HR 60/min). Surgical procedure was uneventfull. The patient was safelly extubated maintaining all infusions except propofol and transferred to the ICU.
Postoperatively, during transition from intravenous to oral antihypertensive medication, he developed an hypertensive spike which led to an epidural hematoma which was drained. At 6 months follow-up he remains free of neurological deficits.
Discussion: Presentation of paraganglioma depends on the cathecolamine secreted by the tumor and the mass effect. On our patient, the later was the leading manifestation.
The clinical case was closely followed by the endocrinology team to control the blood pressure with α and β blockade and to exclude long-term complications of hypertension.
Laryngoscopy and surgical manipulation represented our biggest challenges. Additionally, blood pressure control was essential to maintain a bloodless surgical field.
Usually a period of hypotension follows the excision of the tumor. However, as only one lesion was excised, the patient remained dependent on adrenergic blockade. The control of the blood pressure during recovery period is crucial, especially after neurosurgery and during transition to different routes or type of medications. If successfully performed it can avoid significant complications like epidural hematoma, as seen in our case.
References:
1. Ramakrishna H. Pheochromocytoma resection: Current concepts in anesthetic management. J Anaesthesiol Clin Pharmacol 2015;31:317-23
Learning points: The anesthesiologist should excel in the manipulation of the autonomic nervous system during the whole perioperative period.

06AP05-7
SmartPilot® view-guided target controlled infusion anesthesia can be promising for spinal surgery

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Background: SmartPilot® view (SPV) is a new monitor that takes into account hypnotic-opioid interactions and displays current and predicted anesthesia levels. This is the first report utilizing SPV in neuroanesthesia. We aimed to describe our SPV-guided target controlled infusion (TCI) anesthesia experience in two spinal surgery patients who were monitored with evoked potentials.
Case Report: Written informed consent was obtained from both patients. A 27-year old, ASA I female presented with cervical meningioma. Case 2, 52-year old, ASA II male presented with tethered cord syndrome. The anesthesia protocol consisted of TCI for propofol and manual infusion for remifentanil. Partial muscle relaxation was administered for intubation and further muscle relaxant was avoided. Maintenance of anesthesia was determined to achieve predefined isoboles on SPV. Patients were hemodynamically stable peroperatively. Extubation times were 1min, 3min, respectively.
Discussion: Intravenous anesthesia without muscle relaxants is usually utilized when neuromonitoring is used during spine surgery. However, avoiding muscle relaxants requires use of higher concentrations of propofol. Excessive propofol induces hypotension, which is independently associated with suppression of evoked responses, hemodynamic instability and prolonged recovery. So titration adequate amount of propofol gains importance (1). Although clinical validation of SPV is limited, recent evidence has shown SPV-guided anesthesia reduces anesthetic consumption (2). Thus, it was assumed that SPV would be relevant for patients undergoing spinal surgery. In the presented cases, quality of SPV-guided anesthesia was found superior to our previous practice in regards of perioperative hemodynamic stability, enhanced recovery with no significant impact on monitoring. The reproducibility and clinical reliability of SPV guided TCI anesthesia during neuromonitoring was evaluated in two patients undergone uneventful spinal surgery.
References:
1. Sloan TB, et al. Lidocaine infusion adjunct to total intravenous anesthesia reduces the total dose of propofol during intraoperative neurophysiological monitoring. J Clin Monit Comput 2014;28:139-47.
2. Leblanc D, et al. SmartPilot® view-guided anaesthesia improves postoperative outcomes in hip fracture surgery: a randomized blinded controlled study. Br J Anaesth 2017;119:1022-9
Learning points: SPV can optimise adequate titration of propofol and improve outcomes during spinal surgery

06AP05-8
Non-invasive intraoperative cerebral autoregulation: Monitoring and retrospective calculation of optimal arterial blood pressure in neurosurgical patients

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Background and Objectives: Cerebral autoregulation (CA) may be assessed with the cerebral oximetry index (COx) correlating a surrogate marker of the cerebral blood flow (regional saturation of oxygen, rSO2) with either cerebral perfusion pressure (CPP) or arterial blood pressure (ABP)[1]. An automated curve fitting method with specific software (ICM+®) calculates the "optimal ABP" (ABP_{OPT}), defined as the ABP level where COx reaches its lowest value in an individual patient[2].
Besides the technical challenges, we hypothesized that on-line monitoring of the COx index in patients undergoing long neurosurgical procedures allows a retrospective definition of their intraoperative ABP_{OPT}.
Measurements and Main Results: Retrospective analysis of prospectively collected data in the neurosurgical theatre at Hospital Clinic de Barcelona. 66 patients with continuous (> 2 hours) intraoperative monitoring of invasive ABP and rSO2 with ICM+® software were included.
COx was calculated online as the correlation between 10-second averaged values of rSO2 and mABP over a 300 s period (30 values). CA was considered intact for COx <0.3 and impaired for COx ≥ 0.3. ABP_{OPT} could be calculated in 49 (74%) of the 66 patients analyzed. The relationship between the baseline ABP value at admission (ABP_{BV}), ABP_{OPT} and the average "real" intraoperative ABP (ABP_R) in these patients was also studied.
Ten patients (20.41%) kept their average ABP_R below 20% of their ABP_{BV}. In 30 patients (61.22%) the average ABP_R was lower than the ABP_{OPT}.
Conclusion: On-line CA monitoring with non-invasive COx index is feasible and allows a retrospective calculation of the ABP_{OPT} values in most of the patients of the study. The fact that ABP_R was below calculated ABP_{OPT} in a significant number of patients deserves further analysis.
References:
1. Zweifel, C et al. Continuous assessment of cerebral autoregulation with near-infrared spectroscopy in adults after subarachnoid hemorrhage. Stroke, 2010;

41:1963-8
2. Aries, MJH et al. Continuous determination of optimal cerebral perfusion pressure in traumatic brain injury. Critical Care Medicine, 2012; 40:2456-63

06AP05-9
Anesthesia for cerebral hemispherectomy in Rasmunssen Syndrome - Two clinical cases

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Background: Surgery represents a last resort therapy for epilepsy. Anesthesia perioperative care is essential to outcome.
Case Report: We report the clinical cases of two girls with refractary epilepsy associated with Rasmunssen syndrome (RS), proposed for functional cerebral hemisferectomy with neuronavigation due to rapid uncontrolled clinical progression. Anti-epileptic drug therapy was optimized and mainstained in the preoperative period.
CASE A: 10-year old ASA II girl without additional comorbidities. Anesthesia was mainstained on a remifentanil/propofol target-controlled infusion total intravenous anesthesia along with a rocuronium infusion. Midazolam was administered on induction. Intraoperative convulsion profilaxis with Levetiracetam. An ultrasound-guided central venous catheter (CVC) was positioned on the internal jugular vein. Monitorization with ASA-standard (ASAs) parameters, invasive blood pressure and bispectral index. The procedure was uneventfull and the patient was transfered to the intensive care unit (ICU) under sedation and mechanical ventilation.
CASE B: 7-year old ASA III girl with personal history of early puberty, hemiparesis and obesity. Anesthesia was induced and maintained with a remifentanil/propofol infusions and rocuronium bolus. Valproic acid was chosen for intraopertive convulsion profilaxis. We opted for landmark-guided CVC. The patient was monitored with ASAs parameters, invasive blood pressure and bisepectral index. Surgery went on without mishappenings. The patient was transfered to the ICU under sedation and mechanical ventilation.
Discussion: RS is a progressive disease characterized by drug-resistant focal epilepsy associated with progressive cortical atrophy in more advanced cases, usually affecting one brain hemisphere. Despite its functional consequences, surgery is the most effective method to ensure complete disconnection of the affected hemisphere.
The anesthetic management of these patients includes concern about intraoperative blood loss, as the surgical approach is via a large craniotomy, duration of surgery and delayed recovery, often requiring postoperative ventilatory support and intensive care unit surveillance.
References:
1. Varadkar et al., "Rasmussen's encephalitus: clinical features, phatobiology, and treatment advances", Lacent Neurol. 2014 February; 13(2): 195-205.
Learning points: A multidisciplinary approach to these patients is essential to ensure safety and reduce the risk of complications.

06AP05-10
Anaesthetic considerations in a patient with kernicterus for stereotactic bilateral insertion of deep brain stimulation (DBS) electrodes into internal globus pallidus (GPi) nuclei

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Background: The case we report is about the anaesthetic management of a patient with kernicterus undergoing surgery of DBS of GPi. Kernicterus is a rare neurological complication of indirect hyperbilirubinemia caused by deposits in newborns in GPi that inhibits some important biochemical processes, causing: involuntary movements, asymmetric spasticity, rigidity and ataxia.
Case report: 40 y.o. ASA II female scheduled for stereotactic bilateral placement of electrodes in GPi, guided by computed tomography and under general anaesthesia (GA). Relevant history: generalized dystonia, cervical dystonia and chronic pain. Previous long anaesthetic awakenings. The patient was monitorised with invasive blood pressure, electrocardiogram, pulse oximetry, capnography and bispectral index (BIS). The anaesthesia was induced with 2mcgr/kg fentanyl; 1,5 mg/kg propofol and 0,6mg/kg rocuronium. Orotracheal intubation was performed next and patient was connected to mechanical ventilation. Maintenance was made with TIVA: Propofol infusion (<70mcgr/kg/min) with remifentanil (0.02 mcgr/kg/min). Anaesthetic concentration during microelectrode recordings was reduced by 10%. BIS was maintained between 50-60 during surgery. Surgery continued uneventful and the patient was transferred to the post anaesthesia care unit; and extubated 2 hours later without complications. One week later the patient`s cervical dystonia had improved and also, she referred less disability related to pain.
Discussion: DBS is a treatment for patients with disorders of movement which are refractory to conventional therapies. The most common anaesthetic techniques used in these patients are local anaesthesia or conscious sedation; because they allow for awake patients for intraoperative neurophysiological monitoring and avoid the confounding factor of anaesthetic agents for GPi localization[1]. In some cases, with severe uncontrolled dystonic or in children, GA is required for DBS insertion. Because the patient had severe dystonia it was believed that the best technique was to use TIVA BIS-guided[2], attempting to reduce the doses as much as possible.
Reference:
1. Grant R. et al. Curr Opin Anaesthesiol. 2015;28 (5):505-10.
2. Venkatraghavan MD. et al. J Neurosurg Anesthesiol. 2016; 28 (3):256-61.
Learning point: Thiss report demonstrates that TIVA BIS-guided anaesthetic depth can be an anaesthetic technique for a successful localization and insertion of DBS in the GPi in patients with dystonia in kernicterus.

06AP05-11
EEG predictors of cerebral ischemia as a criteria for the intensive care effectiveness.

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Background and Goal of Study: To identify the features of the EEG wavelet graphs and use them to assess the effectiveness of intensive management of acute and chronic brain ischemia (BI).
Materials and Methods: 198 patients with acute and chronic BI. The first group consisted of patients with severe craniocerebral trauma, the 2nd group with acute cerebrovascular accident, 3rd with apallic syndrome (AS), 4th group with chronic cerebral ischemia (CCI) 2nd degree (different genesis). The control group (CG) consisted of 20 healthy volunteers. The 8-channel EEG was recorded by NIHON KOHDEN EEG-1200 machine. Neurophysiological data were processed by spectral analysis method (Fourier transform, wavelet transform).
Results and Discussion: The minimum frequency and amplitude diversity, typical for wavelet graphs of "normal" EEG in CG, with pronounced stable dominance in a narrow band 9-11 Hz, was a sign of functional integrity and stability of the single central nervous system (CNS).
In patients with AS, a similar monotony of frequency representation was revealed, the stability of the dominant rhythm in the range of 5-6 Hz. Patients with CCI of 2nd degree also had a monotonic frequency and amplitude representation in the 4-8 Hz ranges. This we regarded as wavelet-signs of the already formed simplified pathological system. As response to the therapy with the inclusion of antioxidant agents and preparations with regenerative-reparative agents, minimal changes in the wavelet graphs of the EEG were recorded, with the expansion of the amplitude parameters of the dominant rhythm. We regarded this as predictors of the minimal, inefficient effect of therapy on a rigidly formed PS.
In response to the therapy, the maximum changes in the wavelet EEG graphs were recorded, with the expansion of the frequency and amplitude boundaries of the dominant rhythm (fig. 1,2). This we regarded as signs of effective therapy impact and destruction of the PS by early elimination of the patho determinant.
Conclusion: The amplitude-time representation of the non-stationary EEG signal and its result of continuous wavelet transformation quite effectively allows describing the character of the bioelectrical activity of the brain from the viewpoint of the theory of functional systems. The effectiveness of ongoing neurotropic intensive therapy in acute and chronic MI depends on the degree of formation of the PS.

06AP05-12
Is TCI sufentanil the optimal choice of opioid during general anesthesia for endoscopic surgery resection of pituitary adenomas?

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Background: During endoscopic resections of pituitary adenomas a steady and blood-free surgical field is required. This is ensured, among other factors, by maintaining systolic and mean blood pressure at a pre-specified and stable level. After surgery the patient must almost immediately regain full awareness in order to allow for early neurological assessment.
Opioids remain one of the elements of balanced anaesthesia. In this study we analysed the influence of TCI sufentanil on haemodynamic stability during endoscopic resections of pituitary adenomas.
Materials and Methods: 45 pts (25 F and 20 M); age: 26-84 yrs were anesthetized using TCI sufentanil as analgesic and sevoflurane as inhalational anesthetic. Rocuronium was used to obtain neuromuscular blockade.
23 (51%) of patients had a history of preoperative hypertension.
Results and Discussion: In 41 cases haemodynamic stability was maintained (systolic arterial pressure (SBP) in the resection stage in individual patients ranged from 85 to 110 mmHg, whereas mean arterial pressure (MAP) - from 67 to 80 mmHg). In two cases, due to the low values of SBP and MAP, ephedrine and noradrenaline were administered, respectively. Hypertension requiring the administration of urapidil occurred in two cases.
Two patients had to be administered naloxone in order to rapidly reverse the opioid effect during emergence the patient.
Mean duration of anesthesia was 111 minutes (range: 57.5 - 275 min) and the average total dose of sufentanil was 54.1 μg (range: 27.9 - 116 μg).