Introduction: Since its early development by Dr. Penfield, the goal of awake craniotomy is to achieve optimal tumor excision while preserving eloquent brain regions. The evolution of our understanding of speech mechanisms has allowed for the application of increasingly sophisticated methods of assessing high-level speech function intra-operatively. We utilized an anesthetic approach needless of any airway manipulation\(^1\), thereby optimizing brain mapping conditions and real-time continuous speech assessment during brain tumor resection. We present three cases of repeat craniotomies with an awake approach and we compare this experience with their prior asleep craniotomy, assessing the value of continuous intraoperative speech assessment.

After REB approval and obtaining informed consent, case-reviews were performed for three patients who had undergone awake redo-craniotomy. The standardized anesthetic protocol was based on scalp block and dexmedetomidine infusion as the primary anesthetic agent.\(^1\)

A multidisciplinary team included anesthesia, surgery, medical imaging, nursing and Speech and Language Pathologist (SLP). The SLP completed a preoperative assessment and performed ongoing assessment during tumor resection. Post-operatively, a telephone interview was conducted with the patients following their awake craniotomy. The Wessex Neurological Questionnaire (WNQ) was used and modified to allow for comparison between the procedure performed under general anesthetic and that performed awake.\(^2\)

Results: All three patients had successful excision of the tumor. In each case, SLP provided a systematic evaluation of speech and language function and the surgical team identified that real-time speech assessment directed the surgical plan promoting an optimal tumor excision and preservation of eloquent areas. All patients felt both anesthetic experiences were positive. Results from the WNQ are presented in Table 1.
Discussion: Patient's assessment, preparation and an integrated team-expertise are crucial to the success of an awake craniotomy. The support of SLP allows minimizing postoperative neurological sequelae providing an ongoing assessment during surgery. The preoperative evaluation is the opportunity for the SLP to connect with the patient, engaging in topics that can be used for conversation during surgery.

Interestingly, in these cases the patients were kept awake during tumor resection and the SLP continued conversation with them. One patient had speech arrest during resection of what was mapped to be a safe area and one patient had a seizure. These deficits may not have been detected if the patients had been sedated after brain mapping or if utilizing an anesthetic technique with instrumented airway (e.g. asleep-asleep-asleep).

It's also important for the healthcare team to understand the patients' complex and subjective experience to improve delivery of care. There is limited literature published relating to the comparative anesthetic experience of patients who underwent asleep vs. awake craniotomy. Our findings show patients had a positive experience for both types of surgery. However the awake procedure had a shorter length of stay.

References:

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84365 - MAJOR SPINE SURGERY IN PATIENTS WHO REFUSE BLOOD PRODUCT
TRANSFUSION

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Introduction: Patients undergoing major spinal surgery are at increased risk of intra-
operative bleeding [1]. The management of patients who refuse allogeneic blood
transfusion and undergo complex spine surgery is challenging yet little evidence exists
to guide the peri-operative management of this population [2,3]. This study compared
blood conservation strategies and outcomes between complex spinal surgery patients
who declined (versus those who accepted) blood product transfusion.

Methods: With institutional REB approval and a waiver for informed consent, we used
our institutional Blood Utilization Program database to identify patients who underwent
major surgery for degenerative spine disease and who refused blood product
transfusion between June 1, 2004 and May 31, 2014. Patients who refused blood
transfusion were randomly matched to control patients (who accepted blood
transfusion) based on age, sex, year of surgery, baseline hemoglobin and surgical
location (cervical vs thoracolumbar). A detailed retrospective chart review was
completed. Peri-operative blood conservation strategies and post-operative outcomes
were compared between the two groups.

Results: Seven patients who refused blood transfusion underwent major spinal surgery
for deformity or degenerative correction over the study period and were matched to 27
control patients. Patients who refused blood product transfusion received a greater
number of blood conservation interventions than those who accepted transfusion
(median (range) 5 (3-7) versus 3 (0-6), p < 0.005). The peri-operative hemoglobin nadir
was similar between the two groups (mean (standard deviation) 101 (20) versus 94 (15)
g/L, p=0.27 in the refusal and control groups, respectively). Hospital length of stay was
also similar and there were no deaths identified in either group. No major adverse
events were documented for any patient who refused blood product transfusion.

Conclusion: Our study results describe a cohort of patients who declined blood product
transfusion yet successfully underwent major spinal surgery with similar outcomes
compared to patients who accepted transfusion. Patients who refused blood transfusion
received more aggressive peri-operative blood conservation measures to minimize the
risk of severe anemia.
References:
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Introduction: Use of Depth of Anesthesia (DOA) monitors has been shown to reduce the anesthetic use and to maintain perioperative hemodynamics. Patients with neurological disorders such as Parkinson’s disease are prone to perioperative hemodynamic instability due to preexisting autonomic dysfunction and hence benefit from the use of DOA monitors. Commonly used DOA monitors like Bispectral index (BIS) and entropy are calibrated and validated in healthy subjects with normal cerebral function. The aim of this study was to determine how BIS and entropy perform in relation to the current clinical indices of DOA in patients with neurological conditions.

Materials and Methods: After IRB approval and patient consent we conducted a prospective non-randomized, observational study in patients with neurological disorders undergoing internalization of deep brain stimulators (DBS). All patients received standard general anesthetics with endotracheal intubation and sevoflurane maintenance. Age adjusted MAC (aaMAC) of inhalational anesthetic was maintained between 0.7-1.1 to ensure adequate depth of anesthesia. BIS and entropy sensors were applied on left forehead in all patients prior to induction. BIS, response entropy (RE), state entropy (SE), heart rate (HR) and mean arterial pressure (MAP) and aaMAC at various points from induction to post extubation were collected and analyzed and correlated. RE divergence of more than 10 points from SE is considered as inadequate patient analgesia.

Results: Thirty patients were recruited in this study (mean age was 58.4±11, Male: Female 18:12 and weight 79.2±17). Indication for DBS were Parkinson’s disease (PD) (n=23), essential tremors(2), alzheimer’s disease (2), Dystonia (2) and depression( 1). We found that the trends in BIS, entropy, aaMAC and hemodynamic (HR and MAP) values followed closely during different intraoperative time points except during tunneling. There was a very strong positive correlation between BIS and RE (r=0.870) and BIS and SE (r=0.903), strong positive correlation between aaMAC vs BIS, RE, SE, r=0.476, 0.628, 0.544 respectively. There was no correlation between RE and HR r=...
0.039, RE and MAP 0.167, SE and HR 0.042, SE and MAP 0.147, BIS and HR 0.036, BIS and MAP 0.147. RE divergence from SE were less than 10 throughout indicating optimal patient analgesia.

**Discussion:** Our study showed that BIS and entropy perform reliably in patients with Parkinson’s disease and other neurological disorders. There was a good correlation between BIS and entropy devices. However, HR and MAP are not reliable indicators of depth of anesthesia in this subset of patients probably due to preexisting autonomic dysfunction. Hence BIS and entropy are dependable non-invasive tools to target the administration of anesthetics in these patients. Monitoring of divergence of RE from SE will enable careful titration of opioid analgesics. This helps in preventing chest rigidity, constipation, nausea and vomiting due to excessive opioids.

**References:**


Introduction: Endoscopic surgery is quickly being adopted for multiple surgical interventions, including endoscopic endonasal surgery as an approach to a variety of tumors including functional and nonfunctional pituitary tumors and meningiomas. There are multiple factors known to contribute to postoperative nausea and vomiting (PONV), one of which includes surgical type (1). Endoscopic sinus surgery has been reported to have high rates of PONV, ranging from 40-68% (2), and intracranial procedures reaching rates greater than 40% (3), but PONV in endoscopic skull base surgeries (which combines endoscopic sinus surgery and intracranial surgery) has not been established, nor if any particular antiemetic prophylaxis or therapy is more effective in this specific patient population.

Methods: Following REB approval, a retrospective chart review was completed encompassing all cases of endoscopic endonasal skull base surgery performed at our centre since the procedure’s inception through August 31, 2013. Data obtained included demographics, PONV risk factors, indication for surgery, CSF leak, NPO duration, duration of anesthesia, anesthetic technique, neostigmine use, intraoperative chemoprophylaxis, intraoperative and postoperative opioid doses, presence of PONV and time to discharge from PACU. Data was then analyzed with unpaired Student t-tests, Fisher’s Exact Testing and Binomial Logistic Regression.

Results: A total of 202 cases were reviewed, with 40.1% of patients having PONV. There was no increase of PONV incidence with age (p=0.83), BMI (p=0.36), ASA > 2 (p=0.75), smoking history (p=0.11), NPO duration (p=0.91) or anesthetic duration (p=0.44). Time in the post anesthetic care unit (PACU) was increased from 1.98±0.23 hours to 3.54±0.85 hours (p=0.001) when PONV occurred. With binomial logistic regression analysis (Table 1), further significant variables included non-urgent ASA status (p=0.014), antiemetic prophylaxis (p=0.024) and dose of opioid received in PACU (p=0.02). For PONV chemoprophylaxis, steroids were found to be beneficial (p=0.034) with indication that ondansetron may be helpful (p=0.09), though it did not reach statistical significance.

Discussion: PONV contributes to multiple negative effects including electrolyte imbalance, dehydration, increased ICP, hypertension, surgical site compromise and potential airway compromise which can have major morbidity for patients with recent
intracranial surgery (4). Incidence of PONV was found to be 40.1%, within the range previously described for endoscopic sinus surgery. When PONV occurred, a clinical and statistical increase in time spent in the recovery area is noted, which may contribute to additional health care costs and patient discomfort. Analysis of current practices highlights a few elements that may be beneficial in minimizing PONV risk, including use of antiemetic chemoprophylaxis, especially steroids and potentially ondansetron, minimizing post operative opioids and avoidance of nitrous oxide. Improved understanding of the incidence and contributing factors, as well as current practice regarding prophylaxis and management will ultimately allow for improvement in care of this patient population.

References:


Object: Hemifacial spasm (HFS) is a cranial nerve hyperactivity disorder characterized by unique neurophysiological features. Notably, facial MEP from HFS patients show characteristics suggestive of elevated facial motor neuron excitability [1-4]. In this study, we examine facial motor neuron excitability and compare the effects of desflurane on facial MEP from the spasm and non-spasm side of patients undergoing microvascular decompression (MVD) surgery for HFS.

Methods: 31 patients undergoing MVD for HFS consented to participate in this prospective study. MEP were elicited by transcranial electrical stimulation at C3 and C4 (referenced to Cz) and recorded from the o. oculi (spasm side only), o. oris and mentalis muscles prior to dural opening. Under total intravenous anesthesia (TIVA) and TIVA plus desflurane (0.5 and 1 MAC), MEP activation threshold voltage and mean amplitudes were determined from individual facial muscles as well as pooled data from all muscles on both sides. Mean arterial blood pressure and EEG were recorded at each anesthetic condition.

Results: During TIVA the mean activation threshold for spasm side facial MEP was 162.9 ± 10.1 V compared to 198.3 ± 10.1 V (p = 0.01) on the non-spasm side. Additionally, MEPs were elicited using single pulse transcranial electrical stimulation in 74% of HFS muscles versus 31% of non-spasm facial muscles (p = 0.03). Desflurane (1 MAC) significantly suppressed facial MEP from both the HFS and control sides [Figure 1]. However, the suppressive effects of desflurane were significantly greater on the non-spasm side (79%) versus the spasm side (58.8%). M waves recorded from the mentalis muscle (spasm side) were 1.76 ± 0.2 mV during TIVA and 1.82 ± 0.2 mV with 1 MAC desflurane (p = 0.9) indicating that desflurane was not effecting the neuromuscular junction [5]. Neither blood pressure nor EEG state were significantly different between the 2 anesthetic conditions.

Conclusion: The results of this study suggest that elevated motor neuron excitability is evident on the spasm side of the facial corticobulbar pathway in HFS patients and this
likely explains the differential effects of desflurane on spasm and non-spasm MEP.

References:


Hemodynamic perturbations can be anticipated in deep brain stimulation (DBS) surgery and may be attributed to multiple factors including patient, disease and procedural related characteristics [1-5]. In addition, the effects of other factors such as laterality of implants and same day of battery placement on hemodynamics are still not known. Acute changes in hemodynamics may produce severe complications such as intracranial bleeding, transient ischemic stroke and myocardium infarction [6]. Therefore, this study attempts to determine the incidence of total hemodynamic perturbances (rate) and related risk factors in patients undergoing deep brain stimulation surgery.

**Material and Methods**
After institutional approval, all patients undergoing DBS surgery for the past ten years were recruited for this study. Demographic characteristics including patient’s characteristics, disease and risks factors characteristics, procedural characteristics and intraoperative hemodynamic changes were noted. Event rate (total hemodynamic perturbations in relation to total anesthesia time) was calculated and the effect of all the variables on hemodynamic perturbations (predefined - bradycardia, tachycardia, hypertension, hypotension and ECG changes) was analyzed by regression model. Standard anesthetic technique was used in all patients.

**Results:** Data from 79 procedures were included for the final analysis. Among various characteristics noted, male patients (64.6%), Parkinson disease (50.6%), history of smoking (25.3%), hypertension (33%), bilateral electrode placement (73.4%) and same day battery placement (58.2%) were found to be more common variables in their respective groups [Table 1]. Total hemodynamic adverse events during DBS surgery was 10.8 (0-42) and treated in 57 % of cases. Baseline blood pressure including systolic, diastolic and mean arterial pressure was found to have highly significant effect [14 %, 31 % and 19 % greater chance of adverse hemodynamic event per 10 mm Hg increase in value respectively] on intraoperative hemodynamic perturbations [Table 2]. DBP had the greatest impact among all the hemodynamic parameters. Other variables including type of disease, duration of symptoms, number of medications used, type of nuclei stimulated, laterality of DBS implants and battery placement on the same day had no significant effect on hemodynamic perturbations during DBS surgery (Table 3).
Conclusion: This study is the first detailed description of hemodynamic perturbations associated with DBS surgery in relation to all influencing preoperative and intraoperative possible factors. Among all the factors, baseline blood pressure does significantly affect the hemodynamic perturbations and DBP has highest impact on these events.

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86033 - THE ROLE OF ANESTHESIA SIMULATION IN I-MRI GUIDED NEUROSURGERY

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Introduction: Simulation based practices represent a rapidly evolving field for the perioperative care of patients. [1] The role of simulation in neurosurgical anesthesia is still in its infancy and is mainly limited to management of raised intracranial pressure as well as intraoperative rupture of cerebral aneurysms.

We present 2 cases when pre-procedural simulation was used and highlight the practical value of such an approach when initiating a new i-MRI program. We utilized a simulation technique before commencing the real cases. These simulations assisted us in developing a thorough and clear plan of the perioperative management of the patients prior to starting the actual cases.

Cases: We did two simulation (Fig. 1) using a 3-Tesla 3 Tesla IMRISneuro i-MRI. Two of our nurses agreed [written and informed consent obtained] to volunteer. The first session was performed in supine position and the second session was conducted in prone.

Case 1. A right frontal craniotomy was simulated. In the pre-procedural area, a team of anesthetists, nurses, surgeon and an MRI technician checked the patient for presence of metallic implants or other restricted items. The infusion pumps were placed on the patient’s right side, and the arterial and venous lines were taped to the participant’s left arm to mimic a real case. An endotracheal tube was taped to the patient’s cheek. Hereafter, the surgeon imitated placement of the Mayfield frame (soft blocks), and the patient was properly padded and draped. And after final verification of the procedure checklist, the magnet was moved in and the simulation was uneventfully completed.

Case 2. A case of posterior cranial fossa tumor requiring prone positioning was imitated. While the magnet was in place and the patient in the prone position, we simulated an emergency situation with activation of a Code Blue to determine how much time would be required to remove the magnet, position the patient supine and initiate advanced cardiovascular life support (ACLS). It took 80 seconds to move the
magnet away from the patient’s body so that CPR could be initiated while the patient was still prone. The time required to remove the magnet out of the suite, position the patient supine, attach the defibrillator and deliver the initial shock required almost 2 minutes and 45 seconds. “Restoration of pulse” concluded this unique simulation.

**Discussion:** In our opinion, simulation creates a real perception of the procedure with minute details that are really important for effective case management in the environment of a high magnetic field. We were able to precisely plan the anesthetic, surgical, and radiological strategies in both simulation cases [2-5].

We assessed the feasibility and implications of performing CPR in the i-MRI suite in the presence of a magnetic field. From the second simulation case, we have learnt that it is feasible to apply chest compression within short duration of time (within few seconds) till the magnet is being moved away up to the head of the patient.

**Conclusion:** These simulations assisted us to refine the procedural checklist, develop procedures for urgent situations and develop the skills required for effective management of patients undergoing MRI-guided neurosurgical interventions.

**References:**
