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Summary

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Brain-Heart interaction during ecstatic seizures

Tyrand, Rémi; Iannotti, Giannina Rita; Bartolomei, Fabrice; Bratu, Flavius; Maliia, Mihai Dragos; Nica, Anca; Vulliemoz, Serge; Spinelli, Laurent Jean-François; Schaller, Karl Lothard; Picard, Fabienne

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Blood Biomarkers, Diffusion Tensor Imaging, and Outcome after Mild Traumatic Brain Injury

Malla Mononen^{1,2}, Mehrbod Mohammadian^{1,2}, Iftaker Hossain^{1,2,3}, Timo Roine^{1,4}, Olli Tenovu², Kaj Blennow⁶, Peter Hutchinson³, Henna-Riikka Maanpää^{1,2}, David K. Menon³, Virginia F. Newcombe³, Jean-Charles Sanchez¹⁰, Riikka Takala^{1,2}, Jussi Tallus^{1,2}, Mark van Gils⁵, Henrik Zetterberg^{6,7,8,9,11}, Jussi P. Posti^{1,2}, ¹ University Of Turku, Turku, Finland; ² Turku University Hospital, Turku, Finland; ³ University of Cambridge, United Kingdom; ⁴ Aalto University School of Science, Finland; ⁵ University of Tampere, Finland; ⁶ University of Gothenburg, Sweden; ⁷ Sahlgrenska University Hospital, Sweden; ⁸ University College London, London, United Kingdom; ⁹ Hongkong Center for Neurodegenerative Diseases, China; ¹⁰ University of Geneva, Switzerland; ¹¹ University of Wisconsin, USA

Oral e-Poster Presentations - Booth 3: Trauma and Critical Care 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Association of blood levels of the axonal biomarker neurofilament light and brain white matter (WM) injury in mild traumatic injury (mTBI) has been reported. The purposes of this study were to assess the association between the levels of several non-axonal blood-based biomarkers at admission and WM integrity, measured using post-acute diffusion tensor metrics, and to investigate their associations with outcome in patients with mTBI.

Methods: A total of 92 patients with mTBI (Glasgow Coma Scale \geq 13) having plasma samples for glial fibrillary acidic protein (GFAP), interleukin 10 (IL-10), heart fatty-acid binding protein (H-FABP), S100 calcium-binding protein B (S100B), total tau (T-Tau), amyloid beta 40 and 42 (amyloid B40 and B42) within 24 h of admission and diffusion-weighted magnetic resonance imaging (DW-MRI) \geq 90 days post-injury (median = 231) were included. Patients were divided into computed tomography (CT)-positive and CT-negative subgroups. Outcome was assessed using Glasgow Outcome Scale-Extended (GOSE) at the time of imaging during the follow-up visit. Outcomes were dichotomized as complete (GOSE 8) and incomplete recovery (GOSE $<$ 8). Mean fractional anisotropy (FA), mean diffusivity (MD), axial diffusivity (AD), and radial diffusivity (RD) were calculated from the skeletonized WM tracts of the whole brain.

Results: Admission plasma levels of GFAP, IL-10, and T-Tau had negative correlations with FA and positive correlations with MD, RD, and AD in whole mTBI cohort, in CT-positive group (excluding IL-10), and in incomplete recovery group. In contrast, Ab-42 had a positive correlation with FA in whole mTBI cohort. The levels of S100B had a positive correlation with AD in CT-positive group. CT-positive patients had significantly lower FA levels and higher levels of MD and RD than the CT-negative patients.

Conclusions: Admission plasma levels of GFAP, IL-10, and T-Tau correlate with WM integrity measured \geq 90 days post injury. Higher levels of these biomarkers may be associated with diffuse axonal injury.

Optional Image

Correlation between fractional anisotropy (FA) and biomarkers										
Biomarker	All patients		CT-positive		CT-negative		Incomplete recovery		Complete recovery	
	Spearman r	p-value	Spearman r	p-value	Spearman r	p-value	Spearman r	p-value	Spearman r	p-value
GFAP	-0.231	0.028	-0.325	0.049	0.073	0.608	-0.315	0.019	0.063	0.728
IL-10	-0.223	0.038	-0.310	0.065	-0.064	0.663	-0.455	<0.001	0.096	0.608
H-FABP	-0.128	0.241	-0.216	0.205	0.031	0.834	-0.247	0.074	-0.004	0.981
T-Tau	-0.21	0.045	-0.331	0.045	0.032	0.824	-0.336	0.012	0.081	0.652
S100B	0.035	0.746	-0.164	0.340	0.069	0.639	-0.029	0.836	0.013	0.942
Amyloid B42	0.240	0.024	0.309	0.066	0.233	0.104	0.200	0.146	0.312	0.081
Amyloid B40	0.059	0.580	0.197	0.243	0.169	0.242	0.065	0.636	0.146	0.423

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Endoscopic transorbital approach to the infratemporal fossa. Anatomical feasibility study

Francesco Corrivetti^{1,2}, Sergio Corvino³, Carmine Antonio Donofrio⁴, Matteo de Notaris⁵, ¹ Ebris Foundation, Salerno, Italy; ² San Luca Hospital, Vallo della Lucania, Salerno, Italy; ³ University of Naples "Federico II", Naples, Italy; ⁴ ASST Cremona, Cremona, Italy; ⁵ University Hospital San Giovanni di Dio e Ruggi d'Aragona, University of Salerno, Salerno, Italy

Oral e-Poster Presentations - Booth 2: Skull Base 3 (Approaches and Reconstructive Techniques), October 15, 2024, 9:30 AM - 10:10 AM

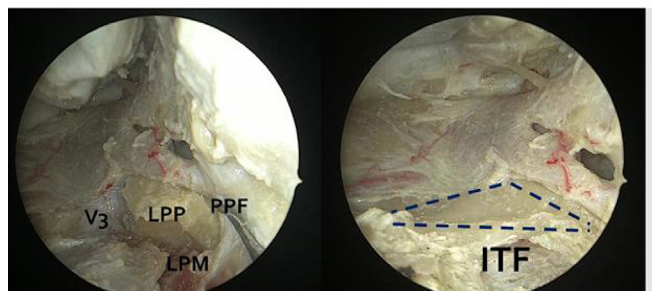
Background: The infratemporal fossa (ITF) is a complex anatomical region. Deep location and high density of critical neurovascular structures contributes to the challenge of accessing the ITF. The historical open surgical approaches (pre and post auricular, transfacial), carried high morbidity rates and unsatisfactory cosmetic results. Therefore, several minimally invasive, endoscopic surgical approaches have been described to provide access to the ITF (endonasal transmaxillary transpterygoid, sublabial transmaxillary, transoral). Superior eyelid endoscopic transorbital approach (SETOA) has been recently described as a possible route to gain a supero-anterior access to the ITF. Moreover, combined endoscopic skull base approaches have gained lot of popularity over the last years, thanks to the refinements of endoscopic technique and anatomical knowledge, providing advantages, particularly in terms of visualization and surgical freedom, and reduction of post-operative morbidities. This study examines the feasibility of combination between endoscopic transorbital and transmaxillary approach as a minimal access technique for ITF. This combination of approaches offers a favorable exposure to the ITF providing multiple angles of attack.

Methods: Surgical dissections were realized on both sides of three cadaver specimens embalmed and injected with colored latex solutions at the Laboratory of Neuroscience EBRIIS (Salerno, Italy) and the Trecchi Human Laboratory (Cremona, Italy). The combined superior eyelid endoscopic transorbital approach (SETOA) and sublabial transmaxillary approach (SLTMA) was performed. Morphometric measurements, angles of attack and surgical field depth were measured on high resolution CT scans by means of neuronavigation system (Medtronic, Luisville, CO). Standard endoscopic instruments (Karl Storz Endoscopy, Tuttlingen, Germany) and high-speed drill were used. Rod-lens endoscopes with 0 and 30 degrees lenses (4-mm diameter, 18-cm length) coupled to a high-definition camera and monitor (Karl Storz Endoscopy, Tuttlingen, Germany) provided visualization during the dissections.

Results: The SETOA allowed to accede the ITF through the inferior orbital fissure (IOF), it provides direct access to the ITF from a supero anterior perspective. On the other hand, SLTMA provide a straight access, after remotion of the posterior wall of the maxillary sinus, to the entire ITF. Combining the approaches enhance the field of exposure, angle of attack, and the instrumentation of the anterior ITF.

Conclusions: This cadaveric study suggests that a combination of minimal access infratemporal approaches can provide adequate exposure of the ITF. This multiport approach can be customized according to the extension of the lesions, as well as the surgical strategy.

Optional Image



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Brain-Heart interaction during ecstatic seizures

Remi Tyrand¹, Giannina Rita Iannotti^{2,3}, Fabrice Bartolomei⁴, Flavius Bratu⁴, Mihai Dragos Malia⁵, Anca Nica⁵, Serge Vulliemoz⁶, Laurent Spinelli⁶, Karl Lothard Schaller¹, Fabienne Picard⁶. ¹ Division of Neurosurgery, Department of Clinical Neurosciences, University Hospitals of Geneva, Geneva, Switzerland; ² HUG-NeuroCentre, University Hospitals of Geneva, Geneva, Switzerland; ³ CIBM, Center for Biomedical Imaging, Geneva, Switzerland; ⁴ Clinical Neurophysiology and Epileptology Department, APHM, Timone Hospital, Marseille, France; ⁵ University of Rennes, INSERM, LTSI-U1099, « Van Gogh » Epilepsy Surgery Unit, Neurology Department, CIC 1414, University Hospital, Rennes, France; ⁶ Division of Neurology, Department of Clinical Neurosciences, University Hospitals and Medical School of Geneva, Geneva, Switzerland

Oral e-Poster Presentations - Booth 1: Functional 1, October 15, 2024, 9:30 AM - 10:10 AM

Background: Ecstatic epilepsy is a rare form of focal epilepsy with seizures including a blissful feeling of increased self-awareness. Heartbeat evoked potential (HEP), the brain response synchronized with the R-peak of heart rhythm, plays an important role in brain-body integration, influencing perception and self-related processes. Heart rate variability (HRV), a marker of autonomic activity, usually shows a shift in autonomic balance toward sympathetic dominance interictally in epilepsy, whereas increased HRV has been shown to correlate with states of higher emotional well-being. We hypothesize that during/after the ecstatic auras there is i) a specific change in HEP, with ii) an increased HRV.

Methods: We investigated brain-heart interaction in patients with epilepsy experiencing ecstatic auras, in terms of heart and brain signals (HRV and HEP). Three patients with drug-resistant ecstatic epilepsy implanted with intracerebral electrodes for epilepsy presurgical evaluation manifested reproducible ecstatic auras when electrical stimulation was applied to the right dorsal anterior insula. HEP and HRV were computed after each induced ecstatic aura (1-3 min sequences, mean total duration: 300 s) and compared to sequences of "control" stimulations of same duration. In the three patients, for both conditions, HRV was computed and HEP inspected for all intracerebral electrodes' contact (Patient_1 = 124, Patient_2 = 175, Patient_3 = 156).

Results: HRV was statistically increased for the three patients in the "ecstatic" condition ($p < 0.05$). HEP evaluated in the left insula in two patients and left inferior frontal gyrus in one patient had a reduced amplitude between 200-350 ms ($p < 0.05$).

Conclusions: Ecstatic aura represents a peculiar case of alteration in self-related processes. In our patients, we could associate this state to a modulation of heart-brain connection, measured in terms of HEP, with significant consistent variations in amplitude ~200 ms after R peak, and an increase in HRV, testifying increased vagal tone.

Optional Image

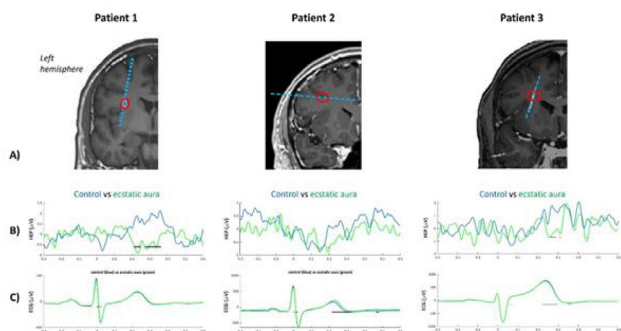


Figure 1. Heart-Brain interaction in ecstatic patients. A) The site in or in the proximity of the left insula where significant modulations of the HEP were observed during ecstatic sensation is indicated on individual patients' MRI (red circle). Brain (i.e., HEP, B) and heart (ECG, C) rhythms are shown for each patient, in ecstatic (green line) and control (blue line) conditions. Periods of significant ($p < 0.05$) difference between conditions are represented by a black line.

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The migratory and invasive behaviour of malignant meningioma cells depends on glucose concentration and glycation

Philipp Selke², Rüdiger Horstkorte², Maximilian Scheer¹. ¹ Department of Neurosurgery, University Hospital Halle, Halle, Germany; ² Institute for Physiological Chemistry, Medical Faculty, Mart-Luther-University Halle-Wittenberg, Halle, Germany

Oral e-Poster Presentations - Booth 4: Neuro-Oncology 5 (Rare tumors), October 15, 2024, 9:30 AM - 10:10 AM

Background: Meningioma is the most common non-malignant intracranial tumour and the risk of developing the disease increases with age. It is known that glucose tolerance decreases with age, leading to higher glucose levels. Like almost all tumours, meningiomas use altered aerobic glycolysis to generate energy, also known as the Warburg effect. This leads to an accumulation of highly reactive by-products such as methylglyoxal (MGO). MGO has been discussed by as a possible link between diabetes, serum glucose levels and cancer. MGO is

20,000 times more reactive than glucose and reacts mainly with proteins, DNA or lipids to form advanced glycation end products (AGEs), a non-enzymatic reaction between the carbonyl groups of dicarbonyls or sugars (such as glucose or fructose) and the amino groups of proteins. However, whether the behaviour of meningiomas depends on glucose levels and glycation has not been investigated. The aim of this study was to investigate the influence of glucose levels and glycation on the migration and invasion behaviour of meningioma cells.

Methods: We used a benign meningioma cell line (WHO grade 1, BEN-MEN1) and a malignant meningioma cell line (WHO grade 3, IOMM-Lee). Cells were cultured for 24h with different glucose levels: normal (5.5mM), low (3mM) and high (15mM) and additionally treated with 0.3mM MGO. Cell cycle analysis was performed with propidium iodide staining using a BD Accuri C6 flow cytometer. Migration was analysed by Electric Cell-substrate Impedance Sensing (ECIS) and invasive behaviour by Real-Time Cell Analysis (RTCA).

Results: We have observed that the cell cycle in the malignant meningioma cell line is influenced by different glucose levels and glycation. At low glucose levels, the cell cycle was slowed down. In addition, the malignant tumour cells showed reduced migration and invasion behaviour at low glucose levels. With the addition of the glycating agent MGO, we saw no more migration and a reduction in invasive behaviour. In contrast, these effects were not observed in the benign meningioma cell line.

Conclusions: This study shows that low glucose levels can reduce the migration and invasion behaviour of malignant meningioma cells. This could be an indication that the western lifestyle may influence the behaviour of meningioma cells. An appropriate diet with a reduction in carbohydrates could lead to a better oncological outcome for patients. This should be further investigated in future studies.

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Keyhole concept applied to Endoscopic Transorbital Approach with and without Lateral Rim Osteotomy: Clinical Experience and Anatomical Reappraisal

Fabio Torregrossa^{1,2}, Cesare Zoia³, Daniele Bongetta⁴, Giovanni Grasso², Maria Peris-Celda¹. ¹ Mayo Clinic, Rochester, United States; ² University of Palermo, Palermo, Italy; ³ Hospital Moriggia Pelascini, Gravedona, Italy; ⁴ Hospital Fatebenefratelli e Oftalmico, Milano, Italy

Oral e-Poster Presentations - Booth 2: Skull Base 3 (Approaches and Reconstructive Techniques), October 15, 2024, 9:30 AM - 10:10 AM

Background: Over the last decade, endoscopic transorbital approaches (ETOA) have gained increased recognition, and their application has expanded. To date, there is still a paucity of data about the clinical impact of ETOA, and its effectiveness and advantages compared to ETOA with lateral rim orbitotomy (LOR) require to be fully elucidated. The keyhole concept in neurosurgery relies on minimizing the craniotomy extension to address deeply located lesions. Investigating this concept in transorbital surgery, this study aims to compare indications, outcomes, and anatomical exposures between ETOA with and without LOR to provide evidence-based indications to choose the most suited transorbital variation.

Methods: Five formalin-fixed, latex-injected cadaveric specimens were used to perform bilateral ETOA with consequent LOR. Dissections were conducted in a stepwise fashion to depict the ETOA and its variation. Measurements were taken to assess and compare the surgical windows and anatomical landmarks. A retrospective analysis of outcomes, complications, and extent of resection of patients who underwent ETOA and ETOA with LOR has been conducted.

Results: Our study characterized the operative corridors of ETOA and ETOA with LOR through high-resolution photographic and endoscopic image acquisition techniques. ETOA with LOR afforded a significantly wider surgical window compared to ETOA alone. However, for posterior orbital lesions and middle cranial fossa (MCF) ones, the ETOA provided optimal anatomical visualization and access. From 2020 to 2023, 29 and 9 patients underwent ETOA and ETOA with LOR, respectively. Of these procedures, 63.6% ETOA and 67.7% ETOA with LOR were for extra-axial tumors. Gross-total or near-total resection was achieved in 93% of ETOAs and 50% of ETOAs with LOR ($p < 0.05$). Minor complications occurred in 16.6% of ETOA and 33.3% of ETOA with LOR ($p < 0.05$).

Conclusions: ETOA with LOR may be used in a wider range of MCF pathologies due to the wider exposure and instrument maneuverability. However, ETOA showed similar outcome results with fewer perioperative complications and