C.05

Direct visualization of the human zona incerta region using ultra-high field imaging: implications for stereotactic neurosurgery

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Background: The zona incerta (ZI) is a small structure in the deep brain first identified by Auguste Forel for which robust *in vivo* visualization has remained elusive. The increased inherent signal from ultra-high field (7-Tesla or greater; 7T) magnetic resonance imaging (MRI) presents an opportunity to see structures not previously visible. In this study, we investigated the possibility of using quantitative T1 mapping at 7T to visualize the ZI region. **Methods:** We recruited healthy participants (N=32) and patients being considered for deep brain stimulation therapy as part of a prospective imaging study at 7T. Computational methods were used to process and fuse images to produce a high-resolution group average from which ZI anatomy could be delineated. **Results:** We pooled 7T data using image fusion methods and found that the contrast from quantitative T1 mapping was strikingly similar to classic histological staining, permitting facile identification of the ZI and nearby structures in reference to conventional stereotactic atlases. **Conclusions:** Using computational neuroimaging techniques, we demonstrate for the first time that the ZI is visible *in vivo*. Furthermore, we determined that this nuclear region can be decoupled from surrounding fibre pathways. This work paves the way for more accurate patient-specific optimization of deep brain targets for neuromodulation.

C.06

A nation-wide prospective multi-centre study of external ventricular drainage accuracy, safety and related complications

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Background: Insertion of an external ventricular drain (EVD) is performed to treat elevated intracranial pressure. EVD catheters are associated with complications such as EVD catheter infection (ECI), intracranial hemorrhage (ICH) and suboptimal catheter placement. As part of the Canadian Neurosurgery Research Collaborative, we sought to investigate the national rate of such complications and their risk factors. **Methods:** Prospective study of 273 patients from eight academic Canadian neurosurgery centres **Results:** Infection rate was 6% and predicted by smaller incisions and not peri-procedure antibiotics, tunneling distance, type of antiseptic used or catheter flushing (p>0.05). The mean duration of EVD was 17.7±3.7 in ECI and ventriculitis group which was significantly higher than in patients without ECI (9.4±8.1) (p=0.045). Although the risk of developing ICH was 9.3%, symptomatic ICH was rare. Pre-procedure pharmacological DVT prophylaxis predicted EVD-related ICH(OR 4.73). The rate of suboptimal catheter location was 31% and predicted by the number of passes (p=0.02), but not image guidance, level of training or catheter placement in an operating room setting (p>0.05). **Conclusions:** This study reports EVD complication rates and their associated risk factors observed within an academic, multi-centre Canadian cohort. This information will help to identify strategies to increase the safety of this common neurosurgical procedure.

C.07

Predicting individualized risk of recurrence: development and validation of a DNA-methylation based nomogram in meningioma

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Background: Challenges in predicting risk of recurrence for individual patients with meningioma limits appropriate selection of patients who may benefit from adjuvant radiation therapy to delay recurrence. Here, we aimed to develop and validate a combined clinicomolecular predictor of early recurrence for individual patients with meningiomas. **Methods:** A methylation-based predictor of 5-year recurrence-free-survival (RFS) was developed using DNA-methylation profiles from a training cohort of 228 patients. Model performance was compared to a standard-of-care histological-based model using three independent cohorts (N=54 ;N=140; N=64 patients). Subsequently, a nomogram that integrated the methylome-based predictor with prognostic clinical factors was developed and validated. **Results:** The methylome-based predictor of 5-year RFS performed favorably compared to a grade-based predictor when tested using the three validation cohorts (ΔAUC=0.10, 95%CI 0.03 – 0.018) and was independently associated with RFS on multivariable Cox regression analysis (HR=3.6, 95%CI 1.8–7.2, P<0.001). A nomogram combining the methylome-predictor with clinical factors demonstrated greater discrimination for recurrence than a nomogram using clinical factors alone (ΔAUC=0.25, 95%CI 0.22–0.27) and resulted in two risk groups with distinct recurrence patterns (HR=7.7, 95%CI 5.3–11.1, P<0.001) and clinical implications. **Conclusions:** Our validated models provide important novel prognostic information that could be used to individualize decisions regarding post-operative therapeutic interventions in meningioma.