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ABSTRACT BOOK

Oral Communication Session 1: On the spectrum of cognitive disturbances

CO1.1

Multimodal meta-analysis of brain integrity in disorders of consciousness

*Arianna Sala1,2,3, Michiel Meys1,2,3, Naji Alnagger1,3, Nikita Beliy4, Simona Abagnale5, Danuta Szirmai6,7, Baris Kaan Ok1, Zhixin Wang1, Marjorie Bardiau8, Charlotte Beaudart9, Simon B. Eickhoff10,11, Daniel Martins12,13,14, Marco Tettamanti15, Steven Laureys16,17,18, Olivia Gosseries1,3, Aurore Thibaut1,2,3, Jitka Annen1,2,3,19**

1Coma Science Group, GIGA-Consciousness, GIGA Institute, University of Liège, Liège, Belgium 2NeuroRecovery Lab, GIGA-Consciousness, GIGA-Institute, University of Liège, Liège, Belgium 3Clinique de la Conscience et NeuroRevalidation, Department of Neurology, University Hospital of Liège, Liège, Belgium 4Human Imaging, GIGA-Cyclotron Research Center Human Imaging, GIGA Institute, University of Li

Introduction:

Disorders of consciousness represent severe neurological conditions that occur following acquired brain injury, with highly variable outcomes ranging from full recovery to prolonged unconsciousness and death. Understanding the precise brain mechanisms underlying this heterogenous group of disorders remains a scientific and medical challenge, impeding progress in the development of treatment or actionable clinical plans. Here, we sought to map the precise spatiotemporal pattern of brain alterations in these patients.

Methods:

We performed a multimodal meta-analysis comprising 90 electroencephalography, magnetic resonance imaging and positron emission tomography studies (3,535 observations from rare patients with a prolonged disorder of consciousness and 1,372 from healthy controls). To generate hypotheses about potential underlying biological mechanisms, we quantified the spatial correspondence between brain circuits robustly associated with disorders of consciousness and openly available atlases of normative features of human brain biology, including maps on neurotransmission, which could inform new receptor-based mechanistic models of disease.

Results:

By assessing 49 electrophysiological features of global brain integrity, we show that, in patients, neural electrical activity is consistently and globally stronger (i.e., spectral power and connectivity) in the delta band and weaker in the alpha band, while broadband entropy and alpha-SD of the participation coefficient best discriminate among patient groups. Using coordinate-based techniques, we identify convergent loss of structure, function and metabolism in specific cortical hubs of the default mode network and in subcortical “cognitive integration zones” of the mediodorsal thalamus and of the executive caudate nucleus, at the interface between default mode and executive, salience and ventral-attention networks. This convergent pattern aligns with specific receptor distributions (mGluR5, GABA-A, μ-opioid, CB1)

and with the noradrenergic transporter topography, identifying putative receptor-level candidates for therapeutic trials.

Conclusions:

Altogether, our findings provide a robust foundation for refining current mechanistic models of disorders of consciousness, identifying promising clinical diagnostic biomarkers within the heterogenous literature and patient profiles, and selecting targets for therapeutic development.

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CO1.2

Dual phase tau PET imaging to characterise and assess prognosis of patients in a memory clinic

Débora Elisa Peretti, Cecilia Boccalini, Giovanni B. Frisoni, Valentina Garibotto
(1)Laboratory of Neuroimaging and Innovative Molecular Tracers (NIMTLab), UNIGE, Switzerland (2)Laboratory of Neuroimaging of Aging (LANVIE), UNIGE, Switzerland (3)Geneva Memory Centre, Department of Rehabilitation and Geriatrics, HUG, Switzerland (4)Division of Nuclear Medicine and Molecular Imaging, HUG,Switzerland (5)CIBM, UNIGE, Switzerland

Introduction:

Dual phase PET protocols of 18F-Flortaucipir can be used to assess deposition of tau tangles (late-phase) and brain perfusion (early-phase) with a single scan in Alzheimer's disease (AD). Combined, this information could provide a precise patient assessment through a single scan. The aim of this study was to assess the diagnostic and prognostic values of a dual phase tau PET scan in a memory clinic population.

Methods:

236 individuals from the Geneva Memory Clinic underwent a dual phase 18F-Flortaucipir PET scan, mini-mental state examination (MMSE), and clinical evaluation within one year. Subjects were classified by diagnosis based on clinical assessment by experts. Standardised uptake value ratios (SUVR) of tau pathology were obtained by normalising to the cerebellar crus, and perfusion to a reference region composed of vermis and pons. Regional uptake was extracted from global and Braak I-VI to assess tau pathology, and from a composite AD region for perfusion. A Kruskall-Wallis test with correction for multiple comparisons was used to assess the differences between diagnostic stages. A multilinear regression was performed to assess the correlation between perfusion and tau, corrected for age, sex, and diagnosis. A sub-sample of 121 individuals underwent a follow-up MMSE at least 1 year after baseline. A linear mixed model was used to estimate the effect of perfusion and tau on MMSE changes using both variables and for each of the variables separately. The Akaike Information Criterion (AIC) was used to select the best model.

Results:

Cognitively unimpaired (CU) had significantly ($p<0.01$) lower age and tau, and higher MMSE and perfusion compared to mild cognitive impairment (MCI) and dementia. Significant differences ($p<0.05$) between MCI and dementia were found in tau and perfusion. Sex was not significantly different between groups. A significant negative correlation between tau and perfusion was found only in Braak VI ($\beta=-0.11, p<0.01$). Longitudinal analysis showed a reduction in MMSE significantly related to higher tau and lower perfusion. AIC for the model combining the two variables was the lowest (AIC=1167), followed by global tau (AIC=1193) and perfusion (AIC=1243).

Conclusion:

Dual phase 18F-Flortaucipir PET scans provide information on cerebral blood perfusion and taudeposit that can be used to identify patients with different diagnoses. Moreover, these parameters provide complementary information to assess global cognitive decline.

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CO1.3

Functional Connectivity Breakdown Between Default Mode and Attentional Networks as a Mechanism of Cognitive Vulnerability Across the Lifespan

Diego Martin Lombardo
Université Savoie Mont-Blanc – Chambéry, France

INTRODUCTION

The balance of functional connectivity between the Default Mode Network (DMN) and Attentional Networks, including the Dorsal (DAN) and Ventral Attention Networks (VAN), is critical for maintaining efficient cognition. Disruption of this balance has been proposed as a shared mechanism underlying cognitive decline and vulnerability to neuropsychiatric conditions. Understanding how this network interaction changes across the lifespan may reveal fundamental mechanisms of cognitive resilience and risk.

METHODS

This work synthesizes results from two recent studies published in Cerebral Cortex Communications (Lombardo & Kaufmann, 2023) and NeuroImage (Lombardo et al., 2025). In the first, resting-state fMRI data from 2,707 adolescents in the ABCD cohort were analyzed to quantify DMN–DAN anti-correlation and its relationship with cognitive performance and sociodemographic risk factors. In the second, multimodal fMRI and PET data from 183 elderly participants with preclinical Alzheimer's disease (ADNI3) were examined to test associations between DMN–DAN coupling, tau and amyloid pathology, and general cognition. Functional connectivity was estimated using group ICA and dual regression analyses.

RESULTS

Across both developmental and aging cohorts, an attenuated DMN–DAN anti-correlation was consistently associated with lower cognitive performance. In older participants, this relationship remained significant after accounting for tau pathology, suggesting a network-level contribution to cognitive decline independent of molecular burden.

CONCLUSIONS

These convergent findings support the view that weakened DMN–DAN anti-correlation represents a lifespan-spanning neural signature of cognitive vulnerability. The results bridge neurodevelopmental and neurodegenerative processes within a unified network framework. Future longitudinal and multimodal studies should investigate causal links between environmental exposures, brain network imbalance, and the emergence of neuropsychiatric and neurodegenerative conditions.

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CO1.4

Ultra-high resolution 18F-FDG PET imaging of the Papez circuit in patients with cognitive disorders

Hélène Goesseye (1,2), Greet Vanderlinden (1,2), Mathieu Vandenbulcke (2,3,4), Rik Vandenberghe (2,3,5), Koen Van Laere (1,2,6)

(1)Department of Imaging and Pathology, KU Leuven, Belgium; (2)Leuven Brain Institute, KU Leuven, Belgium; (3)Department of Neurosciences, KU Leuven, Belgium; (4)Department of Geriatric Psychiatry, University Hospitals Leuven, Belgium; (5)Department of Neurology, University Hospitals Leuven, Belgium; (6)Division of Nuclear Medicine, University Hospitals Leuven, Belgium.

INTRODUCTION

The NeuroEXPLORER (NX, United Imaging Healthcare) is a new ultra-high performance (UHP) brain PET/CT scanner that offers sub-2mm resolution, enabling evaluation of subregions in the Papez circuit (PC). This study aimed to quantify 18F-FDG PET uptake in PC subregions in patients referred for cognitive disturbances as part of a prospective study comparing the NX to standard-of-care (SOC) PET.

METHODS

Thirty patients referred for FDG PET underwent a 15-min SOC PET (37±10 min p.i.) on a GE MI4, immediately followed by a 20-min scan on the NX (68±18 min p.i.) between Sept and Nov 2025. Based on clinical working diagnosis (including PET), patients were divided: 14 Alzheimer's disease, 4 Lewy body dementia, 2 logopenic primary progressive aphasia, 1 semantic primary progressive aphasia, 4 with visually normal scans ("non-neurodegenerative disorders") and 5 classified as "other" with strong psychiatric and vascular comorbidity. PET data were count normalized (SUVR) on the cerebellar cortex. Volumes-of-interest were delineated based on the MASSP 2.0 (small nuclei) and Neuromorphometrics (larger structures) atlas. Asymmetry indices (AI) were calculated as left/right.

RESULTS

Neocortical regions exhibited disease patterns consistent with SOC PET. PC subregions such as the mammillary bodies (MB), anterior thalamus and hippocampal subdivisions were clearly individually resolvable. Although PC group differences were not significant, we found highly significant correlations between the MB AI and the directly connected anterior thalamus (r_p=0.6, p=0.0002), subiculum (r_p=0.5, p=0.005) and posterior cingulate (r_p=0.4, p=0.02), indicating a connected loss of activity within the PC, across disorders.

CONCLUSIONS

This pilot study indicates that NX PET enables metabolic quantification of PC subregion activity at unprecedented spatial detail, providing relevant network-level information. Such an approach can improve the characterization of underlying disease patterns in the differential diagnosis of

cognitive disorders. Further validation in a larger cohort and comparison to high-resolution healthy control data is ongoing.

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CO1.5

Sex-Specific Alterations of Metabolic Connectivity in Subjective Cognitive Decline

Matilde Nerattini (1) (2), Giulia Giacomucci (3), Davide Garcia (1), Elisabetta Maria Abenavoli (2), Flavio Montanini (2), Silvia Maria Rita Tabbì (3), Valentina Moschini (4), Benedetta Nacmias (3), Valentina Bessi (3), Valentina Berti (1) (2)

(1) Department of Biomedical, Experimental and Clinical Sciences "Mario Serio", University of Florence, Italy; (2) Nuclear Medicine Unit, Azienda Ospedaliero-Universitaria Careggi, Florence, Italy; (3) Department of Neuroscience, Psychology, Drug Research and Child Health, University of Florence, Italy; (4) Regional Referral Centre for Relational Criticalities - Tuscany Region, Florence, Italy

Introduction:

Subjective Cognitive Decline (SCD) refers to self-reported cognitive complaints in individuals with normal neuropsychological performance and is considered a potential at-risk condition within the Alzheimer's disease (AD) continuum. Early alterations in large-scale brain networks may already be present. Metabolic connectivity from [^{18}F]FDG-PET may capture subtle early network changes, including within AD-vulnerable systems such as the default mode network (DMN).

Methods:

We retrospectively analyzed [^{18}F]FDG-PET scans from 216 participants: 117 individuals with SCD (81 women, 36 men) and 99 cognitively unimpaired healthy controls (55 women, 44 men). Images were processed using SPM12, and metabolic activity was extracted from 116 AAL3 atlas regions and normalized to global uptake. Sex-specific metabolic connectivity matrices were generated using partial Spearman correlations. SCD vs. HC differences were assessed separately in men and women using Fisher z-tests ($p<0.05$).

Results:

In men, 630 of 6,728 region pairs showed significant SCD-related connectivity differences. Connectivity reductions mainly involved temporal cortico-cortical and limbic cortico-subcortical connections, while increases affected intra-frontal, fronto-parietal, and limbic–cerebellar pathways. In women, 832 significant differences were identified. Connectivity reductions primarily involved frontal and parietal cortico-cortical networks, whereas increases were mainly observed between medial temporal and medial frontal regions and between cortical regions and the cerebellum, suggesting a novel cognitive role of the cerebellum in SCD. Within the default mode network (DMN), connectivity reductions consistent with early pathological vulnerability were observed in both sexes. However, men showed relative preservation of posterior DMN regions, whereas women showed relative preservation of fronto-limbic DMN connections.

Conclusions:

SCD is associated with early alterations in metabolic connectivity within AD-vulnerable networks. These patterns may reflect early network disruptions related to underlying pathological processes, as well as compensatory mechanisms. Sex-specific differences in DMN involvement may indicate differential network responses to early AD-related processes. Metabolic connectivity may represent a useful biomarker for characterizing early network alterations in at-risk populations.

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CO1.7

Progression rates to tau-PET positivity and cognitive impairment risk in preclinical Alzheimer's disease

Stamatia Karagianni (1), Anxo M. Minguillón Pereiro (2), Jesús Silva-Rodríguez (3), Nicolai Franzmeier (4), Michel J. Grothe (3), Pablo Aguiar (5), Alexis Moscoso (1)(5), Michael Schöll (1)
(1)Department of Psychiatry and Neurochemistry, Institute of Neuroscience and Physiology, University of Gothenburg, Sweden. (2)Neurology Department, Complexo Hospitalario Universitario Santiago de Compostela, Spain. (3)Instituto de Salud Carlos III, Spain. (4)ISD Research, LMU Munich, Germany. (5)Nuclear medicine department, Instituto de Investigación Sanitaria de Santiago de Compostela, Spain.

Introduction:

Previous work from our group (Moscoso et al., 2025) has shown that tau-PET-positivity—defined using an FDA/EMA-approved visual interpretation method reflecting Braak stages V–VI (Fleisher et al., 2020)—marks a key milestone linked to symptom onset in preclinical Alzheimer's disease (AD). However, progression rates to tau-PET-positivity and the associated risk of clinical decline in amyloid-β (Aβ)–positive, cognitively unimpaired (CU) individuals remain poorly defined, despite relevance for prevention trials and interpreting Aβ-positivity in absence of PET-detectable tau. Here, we quantify progression to tau-PET-positivity and subsequent clinical progression in Aβ+CU individuals with initially negative tau-PET scans.

Methods:

We included 478 Aβ+CU individuals with baseline and at least one follow-up [18F]flortaucipir PET and Clinical Dementia Rating (CDR) evaluation. A trained reader rated the [18F]flortaucipir scans using an FDA/EMA-approved visual method. Progression rates to different states characterized by tau-PET-positivity or cognitive impairment (CI), defined as CDR≥0.5, were modeled using multi-state Markov models. Age, sex, and APOE-ε4 were included as covariates in all models.

Results:

Among 335 Aβ+CU with negative tau-PET scans (A+T-CU) at baseline, 30.2% progressed to tau-PET-positivity over 5 years (annual incidence: 6.46%), with higher risk among APOE-ε4 carriers (HR=1.68 (95% CI, 1.08-2.61)). Multistate models revealed that individuals remained on average ~5 years in the A+T-CU state and ~4 years in the A+T+CU state.

Transition intensities revealed dominant tau-positivity pathways. The strongest was A+T+CU→A+T+CI (24.7 % annual hazard). Transitions from A+T-CU were slower, while A+T-CI→A+T+CI was rare. Transition rates in A-CU were compatible with those from A+T-CU.

Age increased A+T-CU→A+T-CI risk (HR = 1.10 (95% CI 1.02-1.19)) and APOE-ε4 influenced A+T-CU→A+T+CU (HR = 1.82 (95% CI 1.10-3)).

Conclusions:

Only one-in-three Aβ+CU individuals with a negative tau-PET scan will progress to tau-PET-positivity within 5 years. Once tau becomes detectable, a critical ~4-years-window opens up where preventive interventions could alter clinical outcomes.

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CO1.8

Navigating the Brain: Associations Between Tau Pathology and Spatial Navigation in early Alzheimer's Disease

Van Vrekhem Tineke (1), Balot Emile (2), De Meulenaere Valerie (2), Castegnaro Andrea (3), Sabbe Lode (4), Genbrugge Eva (2), Scarioni Marta (1), Van Langenhove Tim (1), Miatton Marijke (1), Van Weehaeghe Donatienne (2), Boon Paul (1)

(1) Department of Neurology, Ghent University Hospital, Ghent, Belgium; (2) Department of Radiology and Nuclear Medicine, Ghent University Hospital, Ghent, Belgium; (3) Institute of Cognitive Neuroscience, University College London, London, United Kingdom; (4) Department of Rehabilitation, Ghent University Hospital, Ghent, Belgium

Introduction:

Spatial navigation deficits are an early hallmark of Alzheimer's disease (AD). It remains unclear whether different navigation strategies, such as allocentric navigation and navigation based on self-motion cues, show distinct vulnerability to tau accumulation. Identifying system-specific associations may clarify neural mechanisms underlying navigation impairments in early AD.

Methods:

Fifty-three participants (34 cognitively healthy and 19 amyloid-positive MCI patients; 65±7.1 years, 14.5±2.1 yoe, 28 males) completed the Queen Square Virtual Reality task, measuring average distance error across three movement conditions: same viewpoint, shifted viewpoint by walking and by teleportation. All participants underwent tau PET with [18F]PI2620. Standardized uptake value ratios were calculated for the bilateral hippocampus, entorhinal cortex, retrosplenial cortex, parahippocampal gyrus, precuneus, striatum and parietal cortex. Associations between tau PET uptake and navigation performance were tested using multivariate multiple regression. Afterwards, univariate regressions examined condition-specific effects.

Results:

Navigation errors across conditions were associated with tau uptake in the right retrosplenial cortex and precuneus (both $p < 0.05$). Same viewpoint as well as teleportation errors were linked to tau uptake in the left hippocampus, entorhinal (both $p < .001$) and retrosplenial cortex ($p < .01$). Shifted viewpoint (walking) errors were associated with tau uptake in the bilateral hippocampus and entorhinal cortex (left: $p < .001$; right: $p < .01$), as well as left parietal ($p < .001$) and retrosplenial cortex ($p < .01$).

Conclusion:

Increased tau uptake in the hippocampus, entorhinal cortex, and retrosplenial cortex, predominantly in the left hemisphere, is consistently associated with increased navigation errors. Allocentric navigation primarily engages left medial temporal structures, reflecting

reliance on a hippocampal-dependent cognitive map. In contrast, navigation incorporating self-motion cues recruits bilateral medial temporal regions and left parietal and retrosplenial cortices, highlighting integration of egocentric and allocentric information during dynamic navigation. These results suggest that tau pathology disrupts distinct yet overlapping networks depending on navigational strategy.

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CO1.9

Temporal Consistency in Neuroimaging: How Intensity Normalization Affects Longitudinal Hippocampal Atrophy Measurement in Dementia

Longitudinal brain MRI analysis is fundamental to dementia research and clinical practice, enabling measurement of hippocampal atrophy rates—a key biomarker for Alzheimer's disease progression. Yet intensity normalization, typically evaluated for cross-sectional segmentation accuracy, has unexplored implications for temporal consistency in serial imaging. Inconsistent normalization across timepoints can introduce artifactual volume changes that confound true neurodegeneration, potentially leading to misdiagnosis or incorrect treatment decisions. In this work, we conduct the first systematic investigation of how normalization methods affect longitudinal atrophy measurement consistency in hippocampal volumetry. We analyze 450 individuals from ADNI with 2-5 year follow-up imaging, comparing min-max versus Z-score normalization combined with longitudinal registration methods (rigid, affine, deformable). Our findings reveal that min-max normalization introduces systematic temporal instability: within-subject coefficient of variation is 2.8× higher for stable controls ($p<0.001$), and atrophy rate estimates show 34% higher variance across measurement methods. Critically, min-max normalization exhibits scanner-dependent temporal drift—when participants are rescanned on different scanners, artifactual volume changes of 3-7% occur even in anatomically stable regions, mimicking 6-14 months of pathological atrophy. Z-score normalization combined with symmetric diffeomorphic registration achieves 89% temporal consistency (vs 64% for min-max with rigid registration), reducing false-positive atrophy detection by 58% in stable elderly controls. We further demonstrate that these differences have clinical significance: misclassification rates for progressive versus stable MCI differ by 23% between normalization schemes. Our temporal consistency analysis provides mechanistic evidence for Z-score normalization in longitudinal neuroimaging and establishes best practices for robust atrophy measurement in dementia monitoring.

Oral Communication Session 1: On the spectrum of cognitive disturbances

CO1.10

Reference Region Normalization Outperforms Data-Driven Approaches in [^{18}F]FDG PET of Dementia with Lewy Bodies

Antoine Rogeau1,2, Fiene Marie Kuijper1, Hugo Boniface3, Théophile Bieth4, Dario Saracino4,5, Nicolas Villain4,5, Aurélie Kas1,2

1 Department of Nuclear Medicine, Pitié-Salpêtrière Hospital, Assistance Publique-Hôpitaux de Paris Sorbonne Université, Paris, France. 2 Laboratoire d'Imagerie Biomédicale, INSERM U1146, Sorbonne Université, Paris, France. 3 CATI Multicenter Neuroimaging Platform, Saclay, France. 4 Department of Neurology, Institute of Memory and Alzheimer's Disease, AP-HP Sorbonne Université, Pitié-Salpêtrière

Introduction:

Data-driven intensity normalization has recently emerged as an alternative to proportional scaling (PS) and reference-region (RR) methods in brain [18F]FDG PET. We compare them in dementia with Lewy bodies (DLB) patients (n=110, 71.9 ± 6.7 y/o) and healthy controls (HC; n=30, 67.6 ± 5.3 y/o) imaged with [18F]FDG PET/MR.

Methods:

RR-based methods (pons, cerebellum, white matter), PS, iterative proportional scaling (iPS), histogram normalization (HN), iterative histogram normalization (iHN), and SUV conversion were evaluated through voxel-based comparisons (DLB vs HC). Scaling factors (SF) corresponding to the reference-region mean for RR, grey-matter mean for PS, the mode of a template-normalized ratio image for HN, and their subject-specific data-driven counterparts for iPS and iHN were extracted. For each SF, we measured (i) interindividual stability through coefficients of variation (CV, i.e. standard deviation/mean); (ii) disease independence through a) correlation with a DLB-meta-ROI metabolism, and b) percentage of difference between DLB and HC; (iii) temporal stability through longitudinal annual rates-of-change. A composite score was designed to determine the best overall normalization approach.

Results:

Widespread cortical hypometabolism was observed in DLB vs HC using RR and SUV normalization. In contrast, PS, iPS, HN, and iHN revealed cortical hypometabolism together with hypermetabolism in the sensorimotor cortex, basal ganglia, pons, and cerebellum (all $p<0.05$, FWE-corrected). RR normalization yielded smaller DLB-HC differences in SF, weaker correlations with the DLB meta-ROI, reduced CV, and lower rates-of-change compared with PS, iPS, HN, and iHN. The composite score identified white matter as the most accurate RR, followed by the pons.

Discussion:

This is the first systematic assessment of intensity normalization in the largest [^{18}F]FDG-PET DLB cohort to date. Our findings support RR-based normalization—particularly white matter and pons—as the preferred standard in DLB, outperforming PS, HN and data-driven approaches.

Oral Communication Session 2: Movement disorders and traumatic brain injuries

CO2.1

Persistent Male Cholinergic Vulnerability in De Novo Parkinson's Disease: Longitudinal Insights from Clinical and Cholinergic Molecular Imaging

Eline De Meyer (1,2), Giulia Carli (2,3), Sygrid Van Der Zee (3,4), Sofie Slingerland (4), Emile d'Angremont (4), Anne C. Slomp (4), Jeffrey M. Boertien (4), Ingeborg Goethals (1), Sanne Meles (4), Teus van Laar (4)

1 Department of Diagnostic Sciences, University of Ghent, Belgium. 2 Department of Nuclear Medicine and Molecular Imaging, University of Groningen, University Medical Center Groningen, the Netherlands. 3 Department of Neurology, University of Michigan, USA. 4 Department of Neurology, University of Groningen, University Medical Center Groningen, the Netherlands.

Introduction:

Sex-related differences in Parkinson's disease (PD) are well-established, with men showing higher incidence and more severe phenotype. The contribution of the cholinergic system to these differences is still unclear. This study examines sex-specific cortical cholinergic denervation progression over three years in de novo PD.

Methods:

108 newly diagnosed, treatment-naïve PD participants (81 male, 27 females) from the Dutch Parkinson Cohort (DUPARC) underwent clinical assessments and 18F-fluoroethoxybenzovesamicol (18F-FEOBV) PET, a marker of cholinergic synaptic density, at baseline and three-year follow-up. Eighteen healthy controls were used as normative 18F-FEOBV data. Sex differences in 18F-FEOBV signal were assessed using voxel-wise statistical analyses in SPM12 (two-sample t-tests, flexible factorial design) and volume-of-interest (VOI) analyses with linear mixed models, including covariates age for HC-analysis and Hoehn & Yahr stage for PD-analysis.

Results:

Males consistently performed worse on motor and cognitive measures at baseline and follow-up. Compared to controls, females exhibited reduced 18F-FEOBV signal limited to posterior regions, whereas males showed more widespread reductions across occipital, parietal, temporal, and frontal regions. Cholinergic denervation progressed at the same speed in both sexes over 3 yrs., except for a small right middle temporal cluster, showing a steeper decline in females, who had a higher baseline value compared to males (FWE-corrected $p < 0.05$ at voxel-level). Additional VOI-analysis confirmed higher 18F-FEOBV signal in females compared to males over the 3-yr. follow-up period, in left and right transverse temporal gyri (pBonferroni=0.012 and 0.032 resp.).

Conclusion:

Males with de novo PD exhibited more severe cognitive symptoms, combined with a greater cholinergic denervation than women at baseline and 3-yr. follow-up, particularly in the transverse temporal gyri, though the overall progression did not differ. These findings suggest an early and sustained cholinergic vulnerability in de novo male PD, which persists over at least three years of disease progression.

Oral Communication Session 2: Movement disorders and traumatic brain injuries

CO2.2

PET imaging of presynaptic protein SV2A with [11C]UCB-J and [18F]SynVesT-1: a head-to-head comparison in people with Huntington's disease and controls

Jolien Van Opstal (1, 2, 3), Marie Cohilis (4), Aline Delva (1, 3), Haiying Tang (5), John Warner (5), Andrew Wood (5), Wim Vandenberghe (1, 2, 3), Koen Van Laere (3, 4, 6).
(1) Department of Neurology, University Hospitals Leuven, Leuven, Belgium; (2) Department of Neurosciences, KU Leuven, Leuven, Belgium; (3) Leuven Brain Institute, KU Leuven, Leuven, Belgium; (4) Department of Imaging and Pathology, KU Leuven, Leuven, Belgium; (5) CHDI Management, Inc., Princeton, NJ, United States; (6) Division of Nuclear Medicine, University Hospitals Leuven, Leuven, Belgium.

INTRODUCTION

[11C]UCB-J is a widely used PET radioligand for imaging synaptic vesicle protein 2A (SV2A), but its short half-life limits its clinical applicability. [18F]SynVesT-1, with a longer half-life and similar binding properties, is increasingly used as an alternative. A previous [11C]UCB-J PET study reported widespread SV2A loss in people with Huntington's disease (HD). The present study directly compares [11C]UCB-J and [18F]SynVesT-1 PET in manifest people with HD (pwHD) and healthy controls (HC) to evaluate suitability of [18F]SynVesT-1 as a potential biomarker for synaptic density in HD.

METHODS

Ten participants [5 pwHD (4 male; age 55 ± 11 years), HD-Integrated Staging System [ISS] stage 3, UHDRS-TFC > 10; and 5 age- and sex-matched HC (4 male, age 55 ± 11 years)] underwent clinical testing, volumetric MRI, and 90-min dynamic [18F]SynVesT-1 and [11C]UCB-J PET with arterial sampling. Distribution volumes (Vt) were calculated using a one-tissue compartmental model.

RESULTS

PwHD scored significantly worse than HC on UHDRS-TMS, UHDRS-IS, UHDRS-TFC and SDMT. Mean interval between [18F]SynVesT-1 PET and [11C]UCB-J PET was 20±12 days. Volumetric MRI revealed widespread cortical and subcortical atrophy in pwHD compared to HC, most pronounced in the striatum (caudate: -41.3±12.6%; putamen: -33.6±5.6%; both $p<0.001$). Across all regions and groups, [18F]SynVesT-1 PET Vt was lower than [11C]UCB-J PET Vt (range: -10.7±10.4% for nucleus accumbens to -31.1±7.0% for centrum semiovale) and showed smaller variability. SV2A Vt was significantly lower in pwHD than in HC in caudate ([11C]UCB-J: -30.9±14.9%; [18F]SynVesT-1: -28.1±10.2%), putamen ([11C]UCB-J: -26.2±13.2%; [18F]SynVesT-1: -24.6±9.2%) and pallidum ([11C]UCB-J: -19.9±12.5%; [18F]SynVesT-1: -20.3±10.6%). ROI-wise Vt's for [11C]UCB-J and [18F]SynVesT-1 were strongly correlated ($r=0.93$, $R^2=0.87$).

CONCLUSIONS

In manifest HD, both [11C]UCB-J and [18F]SynVesT-1 showed significant SV2A loss in striatum and pallidum. [18F]SynVesT-1 appears to be a viable alternative to [11C]UCB-J for SV2A PET imaging in HD. Further validation in a larger cohort is ongoing.

Oral Communication Session 2: Movement disorders and traumatic brain injuries

CO2.3

Imaging of presynaptic terminals with [18F]SynVesT-1 PET in premanifest Huntington's disease

Jolien Van Opstal (1, 2), Aline Delva (1), Koen Van Laere (3, 4), Wim Vandenberghe (1, 2).
(1)Department of Neurology, University Hospitals Leuven, Leuven, Belgium; (2)Laboratory for Parkinson Research, Department of Neurosciences, Leuven Brain Institute, KU Leuven, Leuven, Belgium; (3)Division of Nuclear Medicine, University Hospitals Leuven, Leuven, Belgium; (4)Nuclear Medicine and Molecular Imaging, Department of Imaging and Pathology, KU Leuven, Leuven, Belgium.

INTRODUCTION

Synaptic damage is believed to play a major role in the pathophysiology of Huntington's disease (HD). Synaptic vesicle protein 2A (SV2A) is present in presynaptic terminals throughout the brain. A previous PET study with the SV2A radioligand [11C]UCB-J in a small number of premanifest HD mutation carriers found significant SV2A loss in caudate and putamen. Here, we assessed synaptic loss in a larger cohort of premanifest HD mutation carriers with the novel SV2A PET radioligand [18F]SynVesT-1.

METHODS

Late premanifest HD participants (HD-ISS stage < 2; CAP100 score > 70) and age- and sex-matched healthy controls (HC) underwent clinical testing, 90-minute dynamic [18F]SynVesT-1 PET and volumetric MRI.

RESULTS

Eleven premanifest HD subjects (7 female; age 43.6 ± 9.0 years; 10 in HD-ISS stage 1 and 1 in HD-ISS stage 0; CAP100 score 87.2 ± 10.3) and 10 HC (6 female; age 43.0 ± 9.7 years) were included. Compared to HC, premanifest HD subjects scored significantly worse on MoCA, UHDRS-TMS, verbal fluency and trail making test A and B. [18F]SynVesT-1 total distribution volume (VT) values in premanifest HD subjects were significantly lower than in HC in putamen (-14.5 ± 7.6%), caudate (-14.3 ± 7.9%) and pallidum (-9.2 ± 6.1%). Significant volume loss was observed in premanifest HD in putamen (-19.9 ± 7.5%), caudate (-17.6 ± 8.1%), pallidum (-14.3 ± 8.3%), nucleus accumbens (-12.2 ± 7.6%) and posterior cingulum (-10.0 ± 11.9%). After partial volume correction, [18F]SynvesT-1 VT in premanifest HD remained significantly lower than in HC in putamen and caudate, but not in pallidum.

CONCLUSIONS

In this first [18F]SynVesT-1 PET study in HD, we find significant synaptic loss in caudate and putamen in the late premanifest phase. Further recruitment of premanifest HD subjects and HC is ongoing and analysis of the complete dataset will be presented at the conference.

Oral Communication Session 2: Movement disorders and traumatic brain injuries

CO2.4

Clinical Utility of [^{123}I]Ioflupane (DATSCAN) in Guiding Dopaminergic Therapy for Parkinsonism

José Pedro R. Escaleira; Rafael Sá e Silva; Martim Monteiro; Ricardo Teixeira; Lúcia Costa
Unidade Local de Saúde (ULS) de Santo António

INTRODUCTION:

The clinical interpretation of parkinsonian syndromes may be uncertain, influencing decisions to initiate, suspend, or adjust dopaminergic therapy. [^{123}I]ioflupane (DATSCAN) SPECT aids in differentiating degenerative from non-degenerative causes. We evaluated its impact on therapeutic decision-making in suspected parkinsonism.

MATERIALS AND METHODS:

We conducted a retrospective study of patients who underwent DATSCAN between 01/2021 and 11/2025 at our centre. Patients with at least two neurological follow-up consultations after imaging were included. Median clinical follow-up was 11 months (95% CI: 8–14). For each patient, dopaminergic therapy prior to DATSCAN result (normal vs abnormal), and subsequent therapeutic decisions (initiate, discontinue or maintain therapy) were recorded.

RESULTS:

A total of 128 patients were included, 74 of whom were female, with a median age at symptom onset of 61 years (IQR 53–72). DATSCAN was performed approximately two years after clinical presentation. Initial diagnostic hypotheses included suspected Parkinson's disease (n=97), atypical parkinsonian syndromes (n=11) and other causes (n=20). In 77 patients, the differential diagnosis considered non-degenerative etiologies, predominantly essential tremor (65%), drug-induced parkinsonism (27%) and functional presentations (8%). Among patients without previous dopaminergic therapy (n=67), DATSCAN was normal in 49; of these, 42 (86%) did not initiate treatment and remained clinically stable during follow-up. The remaining 7 cases were classified as Scans Without Evidence of Dopaminergic Deficiency (SWEDD), typically characterised by poor levodopa response (n=4); after re-evaluation, most were reclassified as essential tremor plus. Among the 18 patients with abnormal DATSCAN, 14 (78%) started dopaminergic therapy, with sustained clinical benefit on long-term follow-up (median 41 months). In patients on dopaminergic therapy prior to DaTSCAN (n=61), the scan was normal in 34; among them, 31 (91%) discontinued therapy, with intolerance reported in only two cases. In the 27 patients with abnormal DATSCAN, treatment was maintained in all, with clinical stability. Overall, DATSCAN directly influenced therapeutic decision-making in 114 (89%) patients.

CONCLUSIONS:

DATSCAN guided discontinuation of unwarranted therapy and supported treatment initiation in patients with dopaminergic deficit, underscoring its role in therapeutic stratification of parkinsonism.

Oral Communication Session 2: Movement disorders and traumatic brain injuries

CO2.5

Cognitive impairment in individuals with chronic spinal cord injury: a Flanker task-based functional magnetic resonance imaging study

Jothini Sritharan (1) (2), Lorenzo Diana (1), Vanessa Vallesi (1) (3), Nicola Brunello (1) (4), Rahel Oertli (5), Inge Eriks-Hoogland (1) (2) (5), Anke Scheel-Sailer (1) (2) (6), Valentina Moro (7) (8), Rajeev K. Verma (1) (2) (5), Giuseppe A. Zito (1) (2)

(1) Swiss Paraplegic Research, (2) Faculty of Health Sciences and Medicine, University of Lucerne (3) Inselspital, Bern University Hospital, (4) University of Bern (5) Swiss Paraplegic Centre (6) Inselspital and Berner Reha Zentrum, (7) University of Verona, (8) IRCSS Sacro Cuore Don Calabria, Verona

Introduction:

Individuals with spinal cord injury (SCI) experience cognitive impairment, with executive functions being among the most affected domains. Even though deficits in executive functions after SCI have been confirmed in previous studies, the related changes in the brain are not understood yet. Therefore, this study aims at investigating the neural correlates of response inhibition, a subdomain of executive functions, in SCI using functional magnetic resonance imaging (fMRI).

Methods:

During the fMRI measurement, participants performed a Flanker task, in which they had to react to the direction of a middle arrow surrounded by other arrows. In the incongruent condition the middle arrow was pointing in a different direction than the other ones, while in the neutral condition the middle arrow was surrounded by squares.

A group-by-condition design using a linear mixed-effects model was applied to compare the performance. Pre-processing of imaging data was conducted in SPM12. With a general linear model, group differences in brain activity were tested. Family-wise error (FWE) correction was applied at a cluster level ($pFWE<0.05$).

Results:

26 individuals with chronic SCI (mean age=45.8±11.0, mean time since injury=13.3±11.1 years) and 26 non-injured controls (mean age=43.1±11.5 years) were recruited. There was a significant interaction effect of group and condition when comparing the performance ($p=0.049$). We found altered brain activity in the left insula ($pFWE=0.033$) and the right precuneus ($pFWE=0.010$) in individuals with SCI compared to non-injured controls in the contrast incongruent versus neutral.

Conclusions:

Brain activity was altered in regions typically involved in executive functions and higher order cognitive processing. As the insula plays a crucial role in response inhibition and interference processing, the altered brain activity may be linked to deficits in resolving conflicts in the Flanker task in individuals with SCI. This study emphasizes the link between cognitive impairment and brain changes in SCI.

Oral Communication Session 2: Movement disorders and traumatic brain injuries

CO2.6

Initial evaluation of 18F-AV133 imaging on the ultra-high performance United Imaging NeuroEXPLORER PET/CT brain scanner for Parkinson's Disease

Lily Porat(1), Lwiza Mulenga(1), Justin Albani(2), Gaia Rizzo(1), Zhen Fan(1), Neha Prakash(2), Jamie Eberling(3), Ken Marek(4), John Seibyl(4), Gilles Tamagnan(2), Roger Gunn(1,5), Graham Searle(1)

(1) Xing Imaging, London, United Kingdom (2) Xing Imaging, New Haven, United States of America (3) Michael J. Fox Foundation, Research Resources, New York, United States of America (4) Institute for Neurodegenerative Disorders, New Haven, CT, United States of America (5) Imperial College London, London, UK

Introduction

The United Imaging NeuroExplorer (NX) is the first dedicated brain PET/CT scanner developed in over 20 years. With unprecedented resolution and sensitivity, it signifies a true step-change in brain imaging technology. Here we present initial findings of a comparison between scans acquired on XingImaging's new NX scanner and a Siemens Biograph with 18F-AV133 (a VMAT2 tracer).

Methods

NEMA and Mini Derenzo phantoms were scanned on the NX scanner, enabling assessments of resolution and sensitivity.

Six subjects (4 prodromal,1 sporadic PD and 1 healthy) were injected with the VMAT2 tracer 18F-AV133 and scanned consecutively on the NX and Biograph scanners. The scanner order was alternated between subjects to control for order effects. Scans were acquired for 10 minutes, 80 or 100 minutes post-injection. 3D iterative TOF PSF reconstruction was used with 4 mm Gaussian filtering for the Biograph and 3 mm Gaussian filtering for the NX. For comparability all the images were registered to a MNI52 template. They were compared visually, with particular attention to small brain regions (the locus coeruleus and substantia nigra) relevant to Parkinson's Disease (PD), and by comparison of intensity profiles through these structures.

Results

The resolution of the NX scanner was measured as 1.4 mm (FWHM), and the sensitivity was 45 cps/kBq. Visual comparison of clinical images and intensity profiles showed that the NX can clearly delineate small brain regions which were not clearly visible on the Biograph.

Conclusions

By comparing phantom and subject data acquired on the NX and on a Siemens Biograph PET/CT scanner, we were able to show the NX's superior image quality and ability to capture previously

unquantifiable small brain regions. This holds great promise for enhancing the ability to study Parkinson's Disease and future studies will evaluate this further.

Oral Communication Session 2: Movement disorders and traumatic brain injuries

CO2.7

Parametric imaging of [18F]PE2I uptake in the substantia nigra pars compacta is feasible with ultra-high performance NeuroEXPLORER PET

Louis Versweyveld (1) (2) , Greet Vanderlinden (1), Charles Carron (1) (3), Marie Cohilis (3), Aline Delva (2), Wim Vandenberghe (2) (4) (5), Koen Van Laere (1) (3) (5)
(1) Nuclear Medicine and Molecular Imaging, Department of Imaging and Pathology, KU Leuven, Leuven, Belgium (2) Department of Neurology, University Hospitals Leuven, Leuven, Belgium (3) Division of Nuclear Medicine, University Hospitals Leuven, Leuven, Belgium (4) Department of Neurosciences, KU Leuven, Leuven, Belgium (5) Leuven Brain Institute, KU Leuven, Belgium

Introduction:

Striatal dopamine transporter (DAT) imaging provides a well-established biomarker for the diagnosis of Parkinson's disease (PD). In contrast, DAT imaging of the substantia nigra (SN), a region central to early PD pathology, has been less reliable due to the SN's lower DAT density and small size. We assessed the feasibility of substantia nigra pars compacta (SNc) DAT quantification and parametric imaging in PD using [18F]FE-PE2I and the ultra-high performance (UHP) NeuroEXPLORER PET system.

Methods:

Two healthy controls (HC) (F, age 61 and 73 years) and five patients with early PD (2F/3M, age 61±9 years, disease duration 2.6±1.1 years) underwent UHP [18F]FE-PE2I PET 0-15 and 50-70 min post-injection. MDS-UPDRS III was used to determine motor manifestation asymmetry. MR-based segmentation (CAT12) defined volumes of interest (VOIs). VOI-based estimates of BPND for the SNc were calculated with a simplified reference tissue model (SRTM) from unsmoothed dynamic images to avoid partial volume effects. Next, BPND parametric images were generated using SRTM2 after applying a 3-mm Gaussian smoothing kernel to reduce the impact of noise at the voxel level.

Results:

Bilateral average SNc BPND ranged from 1.05–1.30 in the HC and ranged from 0.50–0.90 in PD. For comparison, HC caudate and putamen BPND were 3.19–3.89 and 3.82–4.85, respectively, versus 1.39–3.20 and 0.63–2.21 in PD. The side of the most severe SNc BPND reduction was concordant with the side of the most affected caudate nucleus and putamen and contralateral to the clinically most affected side in all patients. The SNc was clearly delineated on BPND parametric images in all subjects.

Conclusions:

UHP PET allows parametric imaging and quantification of nigral DAT in PD patients. The consistent relation between SNc asymmetry and striatal and clinical asymmetry supports the

biological validity of our findings. These preliminary findings motivate further evaluation of nigral DAT loss as a diagnostic or disease progression biomarker in larger PD cohorts.

Oral Communication Session 2: Movement disorders and traumatic brain injuries

CO2.8

Parietal Regional Homogeneity Predicts Recovery Outcomes in Older Patients with Mild Traumatic Brain Injury

Yadong Liu[1], Harm J. van der Horn1, Joukje van der Naalt1, Natasha M. Maurits1, and Mayra Bittencourt2*

1University of Groningen, University Medical Center Groningen, Department of Neurology, The Netherlands
2University of Groningen, University Medical Center Groningen, Department of Ophthalmology, Laboratory for Experimental Ophthalmology

Background:

Older patients with mild traumatic brain injury (mTBI) have heightened risk for incomplete recovery, yet prognostic neural markers remain poorly defined. We investigated whether brain regional homogeneity (ReHo), a measure of local neural synchrony, can function as mTBI-related neural marker and predict symptom burden and functional recovery.

Methods:

Twenty-five older mTBI patients (>60 years) and 20 age-matched controls underwent resting-state fMRI one-month post-injury (3T). Voxel-wise ReHo was computed using CONN toolbox. Group differences and whole-brain correlations between ReHo and severity of injury-related complaints (determined with the Head Injury Symptom Checklist) were assessed ($p < 0.001$ uncorrected, cluster FDR $p < 0.05$). Functional recovery was assessed using the Glasgow Outcome Scale Extended (GOSE). Identified cluster ReHo was correlated with 3-month symptoms and compared between CR (GOSE=8) vs. IR (GOSE<8) groups using permutation tests.

Results:

Patients showed increased frontal and decreased sensorimotor ReHo. Whole-brain correlation identified a right superior parietal lobule (SPL) cluster negatively associated with concurrent complaints ($r = -0.81$, $p < 0.0001$), depression ($r = -0.65$, $p = 0.0002$), and anxiety ($r = -0.58$, $p = 0.002$). One-month SPL ReHo was associated with 3-month symptom severity (complaints: $r = -0.57$, $p = 0.004$; depression: $r = -0.48$, $p = 0.018$; anxiety: $r = -0.44$, $p = 0.033$). IR patients had significantly lower ReHo in sensorimotor regions at 6 months ($p = 0.012$, $r = 0.62$) and SPL at both 3 months ($p = 0.028$, $r = 0.54$) and 6 months ($p = 0.033$, $r = 0.53$).

Conclusions:

Desynchronization in sensorimotor and SPL emerge as a potential prognostic marker. Although parietal ReHo showed no group differences, its strong outcome association suggests individual neural reserve variation. Decreased SPL ReHo predicts persistent symptom burden and

incomplete functional recovery, suggesting that parietal integrity determines individual vulnerability to poor outcomes and supports risk stratification for targeted intervention.

Oral Communication Session 3: Novel techniques and neuroimaging go hand in hand

CO3.1

Effects of a Deep Learning-Based Noise Reduction Algorithm on Visual Analysis and Centiloid Quantification in Amyloid PET Imaging with a Reduced Dose

Ayaz Tahmazov1, Matthieu Doyen1,2, Sébastien Heyer1,2, Laetitia Imbert1,2, and Antoine Verger
1- Department of Nuclear Medicine and the Nancyclotep Imaging Platform, University of Lorraine, Nancy Regional Hospital Centre, Nancy F-5400, France 2- University of Lorraine, IADI, INSERM UI1254, Nancy F-54000, France

Introduction

Reducing the dose and/or acquisition time in amyloid PET could improve patient comfort, radiation safety and cost-effectiveness. In this study, the effects of a deep learning-based noise reduction algorithm (DLNRA) on visual analysis and Centiloid (CL) quantification using simulated reduced doses of [18F] flutemetamol were evaluated.

Methods

Patients with objective cognitive impairment who underwent list-mode [18F]flutemetamol PET were included. Simulated reduced-dose images (50%, 25%, 12.5% and 5%) were generated with and without a DLNRA. A randomly selected 20% subset of the full-dose and reconstructed images were visually assessed as amyloid-positive or negative with confidence scores by two nuclear medicine physicians in consensus. CL values were calculated using validated in-house software. Concordance of the visual analysis results, confidence scores and CL values between native images and reconstructions was analyzed.

Results

A total of 380 PET reconstructions from 38 patients (mean age of 71 years, 17 women, 21 visually positive scans, and median CL of 7.5 (-16.7; 83.4)) were analyzed. The visual classification concordance between the native and reconstructed images was 96% (73/76, with 3 discordant cases at the 5% dose level), with high confidence scores observed down to 25% dose images with the DLNRA. The CL values were highly reliable across all the reconstructions (ICC > 0.99), with mean absolute error confidence intervals that were within the literature-reported values (± 3.95 CL and ± 3.22 CL for positive and negative cases, respectively), except for the 5% dose level with the DLNRA in negative cases.

Conclusions

Amyloid PET dose and/or acquisition time reduction is feasible without compromising diagnostic accuracy. The DLNRA maintained visual diagnostic confidence down to the 25% dose level, whereas CL quantification remained robust down to the 5% dose level without the DLNRA.

Oral Communication Session 3: Novel techniques and neuroimaging go hand in hand

CO3.2

[18F]-Flutemetamol across acquisition timeframes: Clinical Interpretability Combining Visual Read and Centiloids

Ariane Bollack1,2, Chris Buckley1, Adam J Schwarz1, Mark Battle1, Ruben Smith2, Erik Stromrud2, Renaud La Joie3, Gill Farrar1

1GE HealthCare, Pollard Woods, Nightingales Lane, Chalfont St Giles Buckinghamshire HP8 4SP, United Kingdom 2Department of Medical Physics and Biomedical Engineering, Hawkes Institute, University College London, London WC1V 6LJ London, United Kingdom 2Clinical Memory Research Unit, Department of Clinical Sciences Malmö, Faculty of Medicine, Lund University, Jan Waldenströms gata 25, 205 06 Malm

BACKGROUND

Quantification was recently added to the prescribing information of amyloid-PET tracers allowing its use to support visual read. Centiloid scaling is increasingly important for clinical decision-making, and robustness to real-world heterogenous scanning parameters such as the acquisition timeframe post radiotracer injection is essential. We aim to examine the impact of timing on the clinical interpretability of [18F]flutemetamol PET scans, combining visual read and quantification.

METHODS

We analysed two datasets: (1) real-world static scans from the IDEAS study (N=500), and (2) 'dynamic' data reconstructed into pseudo-static frames in the same individual at varying start times and durations (N=89). Visual reads were performed by local and expert readers. Centiloids were calculated using rPOP and linear models were used to assess the impact of acquisition start time and duration on quantification. Measurement variability was compared to test-retest repeatability.

RESULTS

Visual interpretation was robust across acquisition start times, with no significant impact on the ability to classify scans as amyloid positive or negative. Some amyloid-negative scans acquired earlier (60–80min post-injection) exhibited lower grey-white matter contrast, which could reduce expert reader confidence. Quantitative analysis showed that CL values increased with later acquisition times, especially in amyloid-positive scans. In the intermediate CL range (10–30), differences between 60 and 90 min acquisitions were within expected test-retest variability (<6CL). Group-level adjustment factors can partially mitigate timing effects, but substantial individual variability remains. Scan duration (10 vs. 20 min) did not significantly affect interpretation.

DISCUSSION

Combined visual and quantitative assessment of [18F]-Flutemetamol PET scans across the recommended timeframe supports reliable clinical interpretation. While quantitation is increasingly used, visual inspection remains essential. The timing of acquisition on Centiloids is most impactful in high amyloid burden cases, but a universal correction factor is not currently justified due to high individual variability. Consistency in acquisition parameters is recommended for repeat scans.

Oral Communication Session 3: Novel techniques and neuroimaging go hand in hand

CO3.3

Effects of motion and white matter hyperintensities on reference-region ^{18}F-SynVesT-1 quantification in Alzheimer's disease and healthy volunteers

Charles Carron (1) (2), Simon Noë (2), Greet Vanderlinden (2), Michel Koole (2), Georg Schramm (2), Koen Van Laere (1) (2)

1: : Division of Nuclear Medicine, University Hospitals UZ Leuven, Leuven, Belgium. 2: Nuclear Medicine and Molecular Imaging, Imaging and Pathology, Leuven Brain Institute, KU Leuven, Leuven, Belgium.

Introduction

18F-SynVesT-1 is a PET tracer targeting synaptic vesicle protein 2A, a surrogate marker of synaptic density. Simplified quantification using pseudo-reference regions such as the centrum semiovale (CSO) or whole cerebellum (CER) has previously been validated in healthy volunteers (HV) and Alzheimer's disease (AD) patients. This study assessed how motion correction and white-matter hyperintensities (WMH) affect 18F-SynVesT-1 quantification in a cohort of HV and AD patients.

Methods

We reconstructed 18F-SynVesT-1 images for 40 HV and 31 AD patients 60-90 minutes post-injection with 3 motion handling methods: no motion correction (PETnoMOCO); 5 minute frame-based post-reconstruction coregistration and averaging (PETPRFB) and a high-temporal-resolution data-driven motion correction applied during reconstruction (PETDDLM). WMH were segmented from T2-FLAIR images and excluded from the CSO to generate lesion-corrected CSO (LC-CSO) regions. A region-based voxelwise partial volume correction was applied. SUV and SUVRCSO/CER were compared across motion- and lesion- handling methods. Furthermore, the effects on group differentiation were explored.

Results

AD patients showed greater motion and WMH burden than HV. PETDDLM improved image sharpness and increased SUV in high-binding cortical regions (median increase between +0.32% in the insula and +1.04% in the frontal cortex) while reducing SUV in low-binding regions such as the CSO (median -0.53%). For PETPRFB this increased contrast was only the case when there was severe motion. The CER was one of the least affected regions by motion correction (median increase in SUV of +0.36% with PETDDLM). WMH affected CSO SUV only when ≥25% of the region contained lesions and never affected the cerebellar SUV. SUVRCSO yielded better group differentiation than SUVRCER, but only after accounting for motion and WMH. Individual patients' z-scores differed significantly in both directions depending on if SUVRCSO or SUVRCER was used (e.g. mean absolute difference of 1.00+-0.82 in the precuneus).

Conclusion

PETDDLM accounts for smaller movements, attenuation mismatches, improves image contrast and results in more accurate quantification. SUVRCER is less sensitive to motion and WMH than SUVRCSO, making it a more robust reference region. When accounting for these influences SUVRCSO provided slightly better group differentiation than SUVRCER, while on an individual level they might provide complementary information.

Oral Communication Session 3: Novel techniques and neuroimaging go hand in hand

CO3.4

Age-related alterations in resting-state EEG microstate dynamics across adulthood

*Ebru Yıldırım*1, Samet Çelik2*
(*1) Neuroscience and Neurotechnology Center of Excellence (NÖROM), Gazi University, Ankara, Turkey (2) Department of Psychology, Bartin University, Bartin, Turkey

Introduction:

EEG microstate analysis provides a powerful framework for investigating neurocognitive processes and aging in large-scale brain network dynamics. Previous studies have reported age-related changes in resting-state EEG microstate temporal parameters, indicating alterations in large-scale brain network dynamics. However, these studies have largely focused on comparisons between young and older adults, providing limited insight into age-related transitions during middle adulthood. Based on this, we aimed to investigate age-related differences in resting-state EEG microstate temporal characteristics across young, middle-aged, and older adults in the present study.

Methods:

The study included 57 healthy participants, grouped into young, middle-aged, and older adults. The resting-state EEG data (within the eyes-closed condition) were recorded for 5 minutes from 20 channels. EEG data were first preprocessed, and then, EEG microstate analyses were performed using the MİCROSTATELAB toolbox in EEGLAB. Microstate maps were computed using the k-means clustering method at the individual-level and group-level. Seven cluster maps were identified by the clustering method. In backfitting, grand mean cluster maps were used as templates for each patient's microstate maps. Temporal microstate parameters (mean duration, occurrence, and coverage) were computed, and group differences were assessed using Kruskal-Wallis tests in Jamovi.

Results:

There were statistically significant differences in mean duration and mean occurrence ($p<0.05$). Micro-state mean duration showed a gradual decrease from young to middle-aged and older adults, respectively. While pairwise comparisons revealed no significant differences between young and middle-aged participants, significant differences were driven by the older group (for all comparisons, $p<0.05$). In contrast, microstate occurrence for most microstate classes (except for C and E) increased with age, showing the highest values in older adults ($p<0.05$).

Conclusions:

As a result, the present study demonstrated that, consistent with the literature, older adults exhibited shorter microstate durations and increased occurrence rates, indicating faster but less stable large-scale brain network dynamics.

Oral Communication Session 3: Novel techniques and neuroimaging go hand in hand

CO3.5

Non-invasive measurement of cerebrovascular reactivity using 15O-water PET

Elin Bäck (1), My Jonasson (1), Lieuwe Appel (1), Markus Fahlström (1), Torsten Danfors (1), Anders Lewén (2), Mark Lubberink (1)
(1)Molecular Imaging and Medical Physics, Department of Surgical Sciences, Uppsala University (2)Neurosurgery, Department of Medical Sciences, Uppsala University

Introduction:

Cerebrovascular reactivity (CVR) measures the ability of the cerebral vasculature to respond to physiological challenge and provides valuable insight in a wide range of neurological conditions. Although 15O-water PET is the gold standard for measuring cerebral blood flow (CBF), its dependence on an arterial input function (AIF) acquired by arterial cannulation has hampered its widespread use. This study proposes a novel quantitative non-invasive method of measuring CVR using only 15O-water PET data, eliminating the need for an input function.

Aim:

To evaluate a model for input function-free measurement of CVR using 15O-water PET.

Methods:

Healthy controls (n=14) underwent 6-min PET scans after injection of circa 400 MBq 15O-water on a Signa PET/MR (GE HealthCare) at baseline and post-acetazolamide (1 mg/kg). AIFs were measured invasively via a radial artery cannulation. All data was normalized to 400 MBq. Whole-brain CBF and CVR were calculated using the single-tissue compartment model. CVR was also calculated by rearranging the compartment model, analogous to the simplified reference tissue model, eliminating the need for an input function. Additionally, a simple method of integrating the activity of the first 60 s of the scans was used to calculate CVR.

Results:

Mean CVR, using the invasive method, was 1.36 (SD 0.23), non-invasive model 1.37 (0.15), and integral method 1.39 (0.16). Invasive and non-invasive CVR correlate well (r=0.84, p= 0.0001) with a mean absolute bias of 0.01 (0.13) for the non-invasive method. The simple integral method yielded lower correlation to the invasive method (r=0.79, p=0.008) and a larger bias of 0.03 (0.14).

Conclusions:

This study has presented a clinically feasible, non-invasive kinetic model for measuring CVR using 15O-water PET without needing an input function. This method appears reliable provided the amount of injected activity is accurately known or identical between scans and performs somewhat better than the integral method.

Oral Communication Session 3: Novel techniques and neuroimaging go hand in hand

CO3.6

Shortening Vizamyl amyloid PET acquisition time: optimal reconstruction parameters and effect on Centiloids

Emile Balot (1), Tineke Van Vrekhem (2), Yves D'Asseler (1), Valerie De Meulenaere (1), Marta Scarioni (2), Marijke Miatton (2), Stefaan Vandenberghe (3), Tim Van Langenhove (2), Donatienne Van Weehaeghe (1)

(1)Department of Radiology and Nuclear Medicine, Ghent University Hospital, Ghent, Belgium (2) Cognitief Centrum, Department of Neurology, Ghent University Hospital, Ghent, Belgium (3) Medical image and signal processing, Faculty of engineering, Ghent University Vizamyl doses were provided by GE HealthCare for the study.

Introduction:

Alzheimer's disease-related amyloid-β accumulation can be determined with a PET scan. Currently, a 20-minute acquisition is needed which can be challenging in patients with mild cognitive impairment (MCI). Therefore, we investigated whether 1,3,5-minute acquisitions are sufficient on a GE Omni 32 PET camera both on visual assessment and the Centiloid value (CL), a standardised measure of amyloid-β burden.

Methods:

33 patients with MCI (68.8±6.6years, 14 women) underwent amyloid PET scanning. Scans were acquired 90-110min post injection of 150.6±11.1MBq Vizamyl. List-mode reconstructions were performed offline using the GE Healthcare Duetto toolbox. To simulate 90-95min, 90-93min and 90-91min scans, only the first 5min, 3min and 1min of the list-mode data were used, respectively. Optimal parameters for OSEM-PSF and BSREM reconstructions were obtained through visual assessment by an expert nuclear medicine physician. CL was calculated for each scan using the rPOP pipeline.

Results:

Using the 20min reference scans, 23/33 were amyloid positive. Visually optimal parameters for OSEM-PSF were found to be 96, 80, 60 and 40 updates with 4mm post-filtering for 20min,5min,3min and 1min, respectively. Optimal beta-values for BSREM reconstructions were 200(20min), 300(5min), 400(3min) and 800(1min). Visually, at least 3min scans are needed to provide sufficient image quality for clinical interpretation. CL of shorter acquisitions showed only small deviations compared to the CL of full-length OSEM-PSF (mean±SD=54.2±44.7) and BSREM (mean±SD=54.2±45.5) reconstructions. Using OSEM-PSF, 5min, 3min and 1min scans had a mean CL bias±SD of 1.7±2.4, 1.3±3.1 and 0.2±3.9, respectively. For the BSREM reconstructions, the mean CL bias was 1.9±2.5(5min), 1.8±3.1(3min), 0.8±3.8(1min).

Conclusions:

CL stayed remarkably stable for shorter acquisition times, even for 1-min scans. For visual assessment shortening to 3 minutes scans was feasible, allowing for increased patient comfort and more efficient imaging workflow. Future work will include more data and explore motion correction and (deep learning) denoising tools for further enhancement.

Oral Communication Session 3: Novel techniques and neuroimaging go hand in hand

CO3.7

Simultaneous multiple post-labelling delay ASL MRI and [18F]FDG PET in a mixed memory clinic popu-lation and healthy controls

Otto M. Henriksen, Oriol P. Calvo, Frederik J. Bruun, Marie Bruun, Steen G. Hasselbalch, Kristian S. Freder-iksen, Adam E. Hansen, Ian Law, Ulrich Lindberg
Rigshospitalet, Copenhagen, Denmark

Introduction:

The aim of the study was to assess the quantitative and visual concordance of multiple post-labelling delay (multi-PLD) arterial spin labelling (ASL) MRI cerebral blood flow (CBF) measurements and [18F]-fluoro-deoxyglucose (FDG) PET in a mixed memory clinic population.

Methods:

Hybrid [18F]FDG PET/MRI including multi-PLD pseudo continuous ASL from 96 memory clinic patients and 38 elderly controls were analysed along with ASL data from 12 healthy young volunteers. ASL image inter-pretability, concordance with [18F]FDG PET, and value of Z-score maps were rated visually. Regional asso-ciations of CBF with [18F]FDG uptake ratio (SUVr) were investigated by univariate regression and mixed line-ar models. Also influences of age, disease stage and vascular pathology on ASL interpretability and concordance, and whole cortex spatial coefficient of variation (sCOV) were analysed.

Results:

ASL CBF maps were non-comparable to [18F]FDG PET, i.e. uninterpretable or discordant, in 53% of patients, 37% of elderly controls, and 8% of young controls. Only 14% of patient ASL MRI scans were concordant with [18F]FDG PET. Z-score maps were mainly of value in partially concordant scans. Increasing sCOV was strongly associated both with disease severity and with decreasing ASL interpretability and con-cordance, and allowed for identification of uninterpretable scans with 95% sensitivity and 90% specificity. Whole cortex CBF and [18F]FDG SUVr values showed similar distribution across groups, but low to moderate regional associations.

Conclusions:

Multi-PLD ASL provided quantitative CBF measurements correlating with disease severity, but poor image quality and low regional concordance in head-to-head comparison with [18F]FDG PET imaging restricts the clinical use in memory clinic patients.

Oral Communication Session 3: Novel techniques and neuroimaging go hand in hand

CO3.8

Uncovering Hidden Learning Dynamics in Deep Learning Models for Alzheimer's and MCI MRI Using Statistical Complexity

Seyi Olabisi Omotoso and Luiz Otavio Murta Jr
University of Sao Paulo

Introduction:

The diagnosis of Alzheimer's disease, MCI and dementia presents a critical challenge, as these neurodegenerative conditions often involve subtle brain changes that conventional imaging methods fail to detect. Traditional metrics such as loss and entropy capture error and uncertainty but don't uncover the deeper, intricate patterns within MRI data. These limitations restrict early detection and accurate diagnosis, necessitating advanced computational techniques. This study introduces a novel metric that identifies subtle brain patterns, enhancing the understanding of dementia. This metric is called statistical complexity.Methods: Using DenseNet-121 and EfficientNet-B1, the dataset was partitioned into ten subsets ranging from 10% to 100% in 10% increments to examine how statistical complexity evolves with increasing data availability. Synaptic weights were extracted from each model and transformed into probability distributions, from which entropy and disequilibrium were computed. Statistical complexity was then obtained as the product of entropy and disequilibrium, following the definition of LMC complexity.

Results:

Results showed that statistical complexity increases with dataset size. Smaller datasets exhibited an irregular (zigzag) pattern in training loss and statistical complexity, indicating overfitting. Larger datasets demonstrated smoother patterns, suggesting better model learning.

Using the full dataset, a layer-by-layer analysis revealed distinct architectural signatures. DenseNet-121 exhibited increasing complexity in deeper layers—particularly in denseblock3, norm5, and transition3—indicating progressive refinement of high-level neuroanatomical features, while early layers such as conv0 and denseblock2 showed reduced complexity. In contrast, EfficientNet-B1 displayed fluctuating complexity in early layers and consistent declines in mid-layers, stabilizing only at the final layer, suggesting weaker hierarchical feature organization compared to DenseNet-121.

Conclusion:

These findings confirm that statistical complexity is a reliable metric for assessing model performance in Alzheimer's disease classification and may provide more nuanced insights into

model training dynamics. This approach has the potential to significantly improve early diagnosis and model reliability in clinical settings.

Oral Communication Session 3: Novel techniques and neuroimaging go hand in hand

CO3.9

Reducing scan time using 18F Florbetaben Amyloid Brain PET imaging with Digital PET-CT Scanners

Teresa Szyszko (1,2), Bruno Ferreira (1), Amanda Walsh (3), Jannat Khan (1), Reshad Malik (4), Danny McCool (1), Beverley Holman (1,2)
(1)Dept of Nuclear Medicine, Royal Free London, NHS Trust, UK; (2)University College London, UK; (3)Life Molecular Imaging, Fareham, Hampshire, UK; (4)Enfield Memory Service, Chase Farm Hospital, London, UK

Introduction

EANM guidelines in FDG brain PET imaging advise that digital scanners require half the administered activity compared to older scanners. The same effect on overall counts is achieved by decreasing scan time. The manufacturer guidelines for 18F Florbetaben amyloid PET scanning are 10 years old and preceed digital scanners. Our aim was to evaluate diagnostic quality of 18F Florbetaben PET images on digital scanners with standard administered activity but shorter acquisition times.

Methods

We scanned 20 patients (8 on Siemens Biograph Quadra and 12 on Siemens Biograph Vision 600) using 300MBq and 20 minute acquisition, as per current manufacturer guidelines. The data was then re-binned into 5 minute intervals. The quality of images obtained at 20min, 10min and 5 min acquisitions was assessed visually and quantitatively (Syngo MI neurology cortical analysis) using both Iterative and TrueX (point-spread- function) reconstructions and whole cerebellum (WC) as reference regions to obtain SUVr measurements. In three patients we acquired 2 min, 1 min and 30 sec scans.

Results

On visual assessment, 10 min acquisition images were diagnostic on both digital cameras; 5 min acquisition was diagnostic on the Quadra. Statistical analysis of SUVr showed no difference in values at different timepoints, even 30secs. Mean SUVr-scores did not differ between scanners across all durations ($p > 0.63$). Iterative vs TrueX reconstructions also yielded similar SUVr scores, with differences <0.05 units (non-significant $p > 0.6$). Pooling data from all scanners and reconstructions, one-way ANOVA showed no significant effect of scan duration on SUVr-scores ($F(2,97) = 0.012$, $p = 0.988$). Pairwise t-tests (Bonferroni corrected) confirmed no differences between durations.

Conclusion

A 10 minute acquisition gives diagnostic quality 18F-FBB brain PET images on digital scanners with a standard administered activity and can be reduced to 5 mins on the Quadra.

Oral Communication Session 3: Novel techniques and neuroimaging go hand in hand

CO3.10

Differential effects of hypercapnia on cerebral vascular reactivity and glucose metabolism.

T.Vanbutsele(1)(2), A.Castiaux(1)(2), N.Trotta(1)(2)(3), A.Rovai(2)(3), V.Wens(2)(3), G.Leurquin-Sterk(1)(2)(3), X.De Tiège(2)(3).

(1) Université Libre de Bruxelles (ULB), Hôpital Universitaire de Bruxelles (H.U.B), CUB Hôpital Erasme, Department of Nuclear Medicine, Brussels, Belgium , (2) Université Libre de Bruxelles (ULB), ULB Neuroscience Institute (UNI), Laboratoire de Neuroanatomie et de Neuroimagerie translationnelles, Brussels, Belgium , (3) Université Libre de Bruxelles (ULB), Hôpital Universitaire de Bruxelles (H.U

Introduction

Hypercapnic challenge induces potent cerebral vasodilatation and is often used to study cerebrovascular reactivity (CVR) with functional magnetic resonance imaging (fMRI). Still, its impact on neuronal activity remains debated. Functional positron emission tomography (fPET) with 18-Fluorodeoxyglucose (FDG) is an emerging neuroimaging technique to study the dynamics of task-related changes in neurometabolic coupling. We performed simultaneous fMRI and fPET to study the neurometabolic responses and CVR during hypercapnic challenge.

Methods

Twenty healthy adults underwent simultaneous fMRI and dynamic FDG-fPET during alternating 7-min blocks of room-air breathing and hypercapnic challenge (1-min hypercapnia alternating with 1-min room air). fPET and fMRI data were processed/analyzed using standard established pipelines and toolboxes. CVR maps were derived from fMRI signal, accounting for voxelwise hypercapnia delay based on end-tidal CO2 time-course and normalized for second-level analysis. Changes in fPET signal were quantified using percent-signal-change (%SC), cerebral metabolic rate of glucose (CMRglc) derived from an image-derived input function extracted from arteries segmented on time-of-flight MRI sequence, and voxelwise Ki mapping.

Results

At group level, hypercapnic challenge produce delicited significant ($p<0.05$, FWE) positive increase in fMRI correlation signal ($p<0.05$, FWE) across nearly the cortical and subcortical entire grey matter, and major main vascular dural veinous sinuses. Significant group-level changes in fPET signals ($p<0.05$, FWE, cluster level) were only observed in the superior sagittal sinus.

Conclusion

Hypercapnic challenge induces robust vasodilatation across grey matter without detectable neurometabolic change. These findings indicate that fMRI responses to hypercapnia are vascular in origin, and that FDG-fPET provides a neurometabolic signal independent of vascular effects.

Oral Communication Session 4: Amino-acid and neurotransmitter systems visualized

CO4.1

Spatial correlation between 68Ga-FAPI uptake, 18F-FET uptake, and MRI makers of aggressiveness in glioblastoma

Amélie Castiaux(1), Nicola Trotta(1,2), Antonin Rovai(2), Sylvie Luce(3), Florence Lefranc(4), Patrick Flamen(1), Xavier De Tiège(2), Gil Leurquin-Sterk(1).
(1) Department of Nuclear Medicine, Hôpital Erasme, Brussels, Belgium. (2) Université libre de Bruxelles (ULB), ULB Neuroscience Institute (UNI), Laboratoire de Neuroanatomie et Neuroimagerie translationnelles (LN2T), Brussels, Belgium. (3) Department of Medical Oncology, Hôpital Erasme, Brussels, Belgium. (4) Department of Neurosurgery, Hôpital Erasme, Brussels, Belgium.

Glioblastoma is the most aggressive primary brain tumor in adults. Cancer-associated fibroblasts, which express fibroblast activation protein (FAP), are present in the tumor microenvironment of several cancers, including glioblastoma. Gallium-68-labeled FAP inhibitors (68Ga-FAPI) positron emission tomography (PET) in small glioblastoma cohorts revealed marked intratumoral heterogeneity. This study aims to determine whether regions of increased 68Ga-FAPI uptake correspond to locally aggressive tumor areas, by comparing their spatial distribution with established markers of aggressiveness: 18F-fluoro-ethyl-tyrosine (18F-FET) (reflecting amino acid metabolism) PET imaging and MRI contrast enhancement (indicating blood-brain barrier disruption).

Methods

Seven patients (6 men; mean age 60±11 years) with post-operative progressive glioblastoma were prospectively enrolled. 18F-FET tumor volumes (TV-FET) were segmented using a tumor-to-background ratio ≥1.6, as recommended by the PET RANO working group. 68Ga-FAPI tumor volumes were delineated using isocontour thresholds at 10% of lesion's SUVmax (TV-FAPI10). Contrast-enhancing areas (TV-CE) were automatically segmented using Raidionics software, and manually reviewed. Overlap volumes, Dice similarity coefficients (DSC), SUVmax, and SUVmax pic distances were calculated.

Results

Twelve lesions were analyzed. Mean volumes were 12.8±9.4 ml for TV-FAPI10, 15.5±14.5 ml for TV-FET, and 6±6.6 ml for TV-CE. Spatial similarity between TV-FAPI10 and TV-FET was low (DSC=0.46±0.23), although overlap volume reached 81.1±15.9%. Similar findings were observed between TV-FAPI10 and TV-CE (DSC=0.42±0.26), with a higher overlap volume of 94.9±7.9%. Lesions' SUVmax were 1.6 (min=0.3, max=20.6) for 68Ga-FAPI and 3.7±1.3 for 18F-FET, with a distance of 5.7±3.8 mm between 68Ga-FAPI and 18F-FET pic SUVmax.

Conclusion

68Ga-FAPI uptake in glioblastoma is heterogeneous and provides complementary, yet distinct, information to 18F-FET and MRI CE. This heterogeneity likely reflects both blood-brain barrier

disruption and stromal activation within the tumor microenvironment. The high SUV values in some lesions suggest that FAPI-targeted therapy—and potentially theragnostic approaches—could offer new avenues for glioblastoma management, particularly in the context of combination therapies.

Oral Communication Session 4: Amino-acid and neurotransmitter systems visualized

CO4.2

Amino acid PET imaging to monitor mIDH inhibitor treatments in patients with refractory IDH-mutant gliomas

Guilhem Stien1, Tiphaine Obara2,3, Mike Truong4, Timothee Zaragori 5,6, Marie Blonski2,3, Luc Taillandier2,3, Antoine Verger1,6,7

1Nuclear Medicine Department, CHRU of Nancy, Nancy, France. 2Neuro-Oncology Department, CHRU of Nancy, Nancy, France. 3Centre de Recherche en Automatique de Nancy CRAN, UMR 7039, Université de Lorraine, CNRS, Nancy, France. 4Neuroimaging Department, CHRU of Nancy, Nancy, France. 5 CIC 1433, Inserm, CHRU of Nancy, Nancy, France. 6IADI, U1254, Inserm, Université de Lorraine, Nancy, France. 7Nancyclo

Purpose:

Mutant IDH (mIDH) inhibitors represent a novel therapeutic approach for IDH-mutant gliomas. This study aimed to evaluate the role of amino acid PET in monitoring the response to mIDH inhibitor treatment in patients with refractory IDH-mutant gliomas compared with conventional MRI.

Methods:

Patients with confirmed IDH-mutant gliomas who received ivosidenib or vorasidenib between February 2022 and November 2024, with baseline [^{18}F]-FDOPA scans, were included. Lesions were assessed using the RANO 2.0 and PET RANO criteria to determine measurability and, in patients with early follow-up imaging, to predict 6-month progression-free survival (PFS-6).

Results:

Twenty-two patients were included (mean age: 42.1 ± 10.5 years; 8 women; 14 with IDH-mutant astrocytomas). Among them, 11 underwent follow-up imaging with both MRI and PET within the first 100 days of treatment. At baseline, MRI identified measurable lesions in 10 of 22 patients (45%), whereas amino acid PET identified lesions in 20 of 22 patients (91%) ($p< 0.01$). In patients with early follow-up, the RANO 2.0 criteria predicted PFS-6 with 91% accuracy (10/11) compared with 82% accuracy (9/11) with PET RANO ($p>0.05$). The only discordant case showed progression on PET but stability on MRI, with confirmed clinical progression at 10 months post-treatment initiation.

Conclusion:

Amino acid PET is a valuable tool for monitoring treatment with mIDH inhibitors in patients with refractory IDH-mutant gliomas, and its performance is at least comparable to that of MRI. Additionally, compared with MRI, amino acid PET can detect more measurable lesions, highlighting its complementary role in monitoring the treatment of IDH-mutant gliomas.

Oral Communication Session 4: Amino-acid and neurotransmitter systems visualized

CO4.3

Microvascular physiology in glioma using dynamic [^{18}F]FET LAFOV PET/CT and Tikhonov model-free deconvolution

Christian Engkebølle(1), Ulrich Lindberg(2), Otto Mølby Henriksen(1), Karine Madsen(1), Thomas Lund Andersen(1), Thomas Urup(3), Rune Rasmussen(4), Ian Law(1), Henrik Bo Wiberg Larsson (2)

(1)Department of Clinical Physiology and Nuclear Medicine, (2)Functional Imaging Unit Department of Clinical Physiology and Nuclear Medicine, (3)Department of Oncology, (4)Department of Neurosurgery. Copenhagen University Hospital Rigshospitalet, Copenhagen, Denmark

Introduction: The gain in sensitivity and temporal resolution obtained by long axial field-of-view (LAFOV) PET/CT systems can be exploited to capture the fast transient effect of the vascular bolus passage of a PET tracer in tissue using the kinetic models applied in perfusion MRI. We evaluated the feasibility of obtaining quantitative measures of microvascular physiology directly from dynamic [^{18}F]FET PET using Tikhonov model-free deconvolution in a clinically heterogeneous glioma cohort.

Methods: In this retrospective study, 23 dynamic 40-min [^{18}F]FET PET/CT scans were obtained by a Siemens Quadra LAFOV PET/CT scanner from 22 glioma patients. The data were analysed using an aortic image-derived input function (IDIF) and Tikhonov model-free deconvolution to estimate tissue perfusion (f), mean transit time (MTT), volume of distribution (Vd), unidirectional influx constant (K1) and extraction fraction (E). Regions of interest (ROIs) comprised normal-appearing grey matter (GM) and white matter (WM), metabolic tumour volumes (MTV) and MRI-defined contrast-enhancing (CE) and FLAIR abnormalities.

Results: GM and WM replicated the expected separation in perfusion, with average f 59.8 vs 18.9 ml·100 ml^{-1}·min^{-1}, shorter MTT (22 vs 42 s), higher Vd (31 vs 21 ml·100 ml^{-1}) and higher K1 (2.0 vs 1.2 ml·100 ml^{-1}·min^{-1}) in GM, while E was lower in GM than WM (3.5 vs 6.7%; all $p < 0.001$). Glioma MTV exhibited f comparable to GM and higher than WM, with prolonged MTT and increased Vd, K1 and E. Perfusion parameters did not differ significantly by WHO grade, histology or IDH status, whereas unsupervised clustering identified two distinct perfusion phenotypes.

Conclusion: Dynamic [^{18}F]FET LAFOV PET with Tikhonov model-free deconvolution provides physiologically plausible quantitative perfusion measures and tracer extraction in glioma and normal tissue. The study supports further investigation of [^{18}F]FET-derived parameters of microvascular physiology as imaging biomarkers obtainable in addition to routine metabolic measurement.

References: Larsson HBW, Law I, Andersen TL et al. Brain perfusion estimation by Tikhonov model-free deconvolution in a long axial field of view PET/CT scanner exploring five different PET tracers. Eur J Nucl Med Mol Imaging. 2024;51:707-720

Oral Communication Session 4: Amino-acid and neurotransmitter systems visualized

CO4.4

Longitudinal brain metabolism changes map distinct neuromodulatory networks in autoimmune encephalitis

Federico Massa[1,2], Denise Cerne[1], Giulia Benvenuto[1], Stefano Raffa[2], Alessia Panza[1], Giacomo Bavestrello[1], Carolina Barone[1], Anastasia Lechiara[3], Emanuela Maria Mobilia[3], Giacomo Rebella[2], Pietro Mattioli[1,2], Beatrice Orso[1], Dario Arnaldi[1,2], Flavio Villani[2], Luca Roccatagliata[2,4], Giampaola Pesce[3], Matteo Pardini[1,2], Silvia Morbelli[5,6], Antonio Uccelli[1,2], Luana Benedetti[2]

[1] Department of Neuroscience, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health, University of Genoa, Genoa, Italy [2] IRCCS Ospedale Policlinico San Martino, Genoa, Italy [3] Autoimmunology Laboratory, IRCCS Ospedale Policlinico San Martino, Genoa, Italy [4] Department of Health Sciences (DISSAL), University of Genoa, Genoa, Italy [5] Department of Medical Sciences, University of Turin

Background:

Autoimmune encephalitis (AE) shows a reproducible longitudinal [^{18}F]FDG PET signature, with acute hypermetabolism localized to limbic–striatal–thalamic territories and relative hypometabolism predominating in posterior associative cortex (temporo-parietal/precuneus), both partially reversible under immunotherapy. Whether these motifs preferentially engage specific neuromodulatory systems is unknown.

Methods:

Twenty-two patients with AE underwent [^{18}F]FDG PET at clinical baseline (BS) and follow-up (FU). After standard PET preprocessing (spatial normalization to MNI space, smoothing and proportional intensity scaling to whole-brain uptake), JuSpace (option 6) was used with BS and FU images for each patient, yielding regional ΔBS–FU vectors to be Spearman-correlated with normative PET/SPECT maps of dopaminergic, cholinergic, serotonergic, noradrenergic, GABAergic, and glutamatergic systems. Subject-wise correlations were Fisher-z transformed and controlled for multiple comparisons using Benjamini–Hochberg FDR ($q \leq 0.05$ for statistical significance). Spatial co-localization was interpreted as overlap in regional involvement, not as directionality of transmitter signalling.

Results:

After FDR-BH correction, longitudinal metabolic change showed positive spatial associations with dopaminergic and cholinergic enriched territories (DAT, VAChT, α4β2 nicotine receptor) and a negative association with 5-HT2A. The cholinergic/dopaminergic alignment matches the acutely hypermetabolic limbic–striatal circuit, whereas the 5-HT2A alignment situates reversible posterior hypometabolism within serotonergically enriched association cortex.

Conclusions:

In AE, acutely altered regions tending to normalization with therapy co-localize with distinct neuromodulatory territories. Embedding longitudinal [^{18}F]FDG PET into a normative receptor space extends previously described framework with systems-neurochemical information and suggests that dopaminergic/cholinergic subcortico-limbic and 5-HT2A-rich posterior association regions constitute plausible targets for pharmacological and neuromodulatory strategies.

Oral Communication Session 4: Amino-acid and neurotransmitter systems visualized

CO4.5

Quantitative [18F]FET PET for Pituitary Neuroendocrine Tumours (PitNET): A Case-Control Study Comparing Pathologically Confirmed functional PitNETs wi

Ilanah J. Pruis (1) (2), Marcel Segbers (1), Anita A. Harteveld (1), Sophie E.M. Veldhuijzen van Zanten (1) (2) (3)
(1) Department of Radiology & Nuclear Medicine, Erasmus Medical Centre Rotterdam, Rotterdam, the Netherlands; (2) Brain Tumour Centre, Erasmus MC Cancer Institute, Rotterdam, the Netherlands; (3) Medical Delta, Delft, the Netherlands

Introduction:

Amino acid PET may aid accurate localization of small pituitary neuroendocrine tumors (PitNETs), particularly when MRI is inconclusive. This matched case-control study quantitatively characterizes [^{18}F]fluoroethyl-L-tyrosine ([^{18}F]FET) uptake in pathologically confirmed functional PitNETs compared with the normal pituitary gland, establishes physiological and pathological reference values, and evaluates optimal tumor-to-background ratios (TBR) for discrimination.

Methods:

Twenty-two preoperative scans from 20 patients with clinically confirmed Cushing disease (n=17) or acromegaly (n=3) were retrospectively analyzed. All lesions were pathologically confirmed small functional PitNETs following transsphenoidal surgery. A matched control cohort (n=22) consisted of glioma patients with a normal pituitary gland on MRI. Imaging was performed on a 3.0-T PET-MRI system and reconstructed using an in-house pipeline (b-value 150). Standardized uptake values (SUVs) were extracted from manually defined volumes of interest (VOIs) in PitNETs and normal pituitary glands. Physiological background was assessed using three reference VOIs (crescent-shaped cerebral, threshold-based cerebellar, fixed-volume cerebellar) and a pooled cavernous sinus VOI. Diagnostic performance was evaluated using correlation- and receiver operating characteristic (ROC) analysis.

Results:

[^{18}F]FET uptake was significantly higher in PitNETs than in the normal pituitary gland (SUVmax: 2.9±0.9 vs. 2.0±0.5, $p<0.001$). The crescent-shaped cerebral VOI demonstrated the lowest variability and was selected as the optimal reference. Both for TBRmax (2.5±0.8 versus 1.8±0.4; $p=0.003$) and the PitNET-/normal pituitary gland-to-CS ratio (1.1±0.4 versus 0.7±0.1, $p<0.001$) a statistically significant difference was observed between PitNET and normal pituitary gland. ROC analysis identified TBRmax as the most reliable discriminator, with a cutoff of 2.0 (sensitivity 73%, specificity 64%; AUC 0.757, 95% CI 0.614–0.900).

Conclusions:

Quantitative [^{18}F]FET PET demonstrates increased uptake in functional PitNETs compared with the normal pituitary gland. The crescent-shaped cerebral reference VOI provides the most robust normalization. These findings establish initial quantitative reference values for physiological and pathological pituitary uptake, representing an important step toward standardized assessment of small functional PitNETs using [^{18}F]FET PET.

Oral Communication Session 4: Amino-acid and neurotransmitter systems visualized

CO4.6

Uncovering Hidden Prognostic Phenotypes in Glioblastoma: A Composite-Parameter Radiomic Stratification Framework for Equitable AI

Nicholas Laflamme, Albino Nikolla, Dr. Augusto Da Mota Goncalves Filho
Dalhousie University, University of Ottawa, The Ottawa Hospital Research Institute

Current AI models in neuro-oncology frequently fail to generalize due to reliance on coarse clinical labels that mask underlying tumor heterogeneity. To enable the generation of fair, representative synthetic data via Generative Adversarial Networks (GANs), it is necessary to first identify granular, data-driven patient phenotypes. We hypothesize that unsupervised radiomic clustering can uncover prognostic subgroups distinct from standard molecular classifications, providing the essential "ground truth" labels required to correct AI bias.

We analyzed multi-parametric MRI (mpMRI) scans from the UPENN-GBM dataset (n=599). A total of 432 radiomic features (morphology, intensity, texture) were extracted from the enhancing tumor, necrotic core, and edema using the CaPTk toolkit. The pipeline employed a sequential dimensionality reduction strategy: standardization, PCA (30 components), and UMAP (3 dimensions). Cluster stability was optimized using a novel multi-objective composite parameter map that balanced cluster count, size, and noise to empirically identify robust HDBSCAN parameters. Structural robustness was validated via Adjusted Rand Index (ARI) analysis across 100 stochastic seeds.

Stability analysis confirmed that a 3D UMAP embedding yielded the highest structural consistency ($r=0.92$). Using the composite mapping, we identified an optimized parameter subspace where 91.4% of radiomic features differed significantly across subgroups ($p < 0.01$, Kruskal-Wallis). Kaplan-Meier analysis revealed that these radiomic clusters were significantly prognostic for Overall Survival (Log-rank $p < 0.05$). Crucially, these subgroups were statistically independent of standard prognostic markers, including IDH1 mutation, MGMT methylation, Age, and Gender (all $p > 0.01$).

We present a validated, unsupervised framework for defining glioblastoma subtypes driven by intrinsic tumor morphology rather than demographic artifacts. These clusters provide a robust, clinically significant stratification that is orthogonal to traditional molecular profiling. This stratification serves as the necessary conditioning foundation for cluster-aware cGANs, enabling the development of more equitable and generalizable AI systems in medical imaging.

Oral Communication Session 4: Amino-acid and neurotransmitter systems visualized

CO4.7

In-vivo imaging and quantification of central noradrenaline transporters using [^{11}C]MRB PET/MRI in adults with ADHD and emotional dysregulation

N. Mauche (1), M. Rullmann (2), J. Huang (1), O. Sabri (2), S. Hesse (2), M. Strauß (1)
(1) Department of Psychiatry and Psychotherapie, University of Leipzig Medical Center, Leipzig, Germany, (2) Department of Nuclear Medicine, University of Leipzig Medical Center, Leipzig, Germany

Introduction:

Adult attention-deficit/hyperactivity disorder (ADHD) is frequently accompanied by emotional dysregulation (ED), a dimension associated with impulsivity and noradrenergic signaling but absent from current diagnostic criteria. Positron emission tomography (PET) studies indicate altered noradrenaline transporter (NAT) availability in ADHD, yet NAT alterations linked to ED remain unclear. Stratifying ADHD by ED may refine clinical phenotyping and clarify neurobiological heterogeneity.

Methods:

Participants underwent simultaneous PET/magnetic resonance imaging (PET/MRI) on an integrated mMR Biograph scanner. MRI included three-dimensional T1-weighted magnetization-prepared rapid gradient echo (3D T1-MPRAGE) for region-of-interest (ROI) definition, and blood-oxygen-level-dependent functional MRI (BOLD fMRI) to assess resting-state networks. NAT availability was measured with the selective radioligand (S,S)-O-[^{11}C]methylreboxetine ([^{11}C]MRB). Dynamic PET data were motion-corrected, co-registered to T1 images, and quantified using the multi-linear reference tissue model 2 (MRTM2) with the occipital cortex as reference. Regional distribution volume ratios (DVR) indexed NAT across ROIs implicated in attention and inhibitory control.

Results:

Interim analyses compared NAT DVR between ADHD participants with and without ED. The sample included 13 individuals with ADHD+ED (28.9 ± 4.3 years; 9 females) and 20 without ED (28.3 ± 4.4 years; 17 females). Group contrasts, regional DVR patterns, and implications for ED-related noradrenergic alterations will be presented.

Conclusion:

Identifying NAT differences between ADHD subgroups may support biomarker development and refine neurobiological models. Imaging-derived NAT DVR could complement clinical diagnosis, improve specificity, and aid pharmacological evaluation or treatment prediction. Given the prevalence and functional burden of adult ADHD, biologically informed diagnostic and therapeutic strategies are clinically relevant.

Oral Communication Session 4: Amino-acid and neurotransmitter systems visualized

CO4.8

The confounding effects of microvascular physiology on the uptake and diagnostic accuracy of [18F]fluoroethyl-tyrosine positron emission tomography in

Otto M. Henriksen, Thomas L. Andersen, Karine Madsen, Benedikte Hasselbalch, Dorte S. Nørøxe, Vibeke A. Larsen, Ulrich Lindberg, Henrik B.W. Larsson, Adam E. Hansen, Ian Law
Rigshospitalet, Copenhagen, Denmark

Introduction:

The aims of the study were to investigate the physiological influence of tissue perfusion and permeability on O-(2-[18F]-fluoroethyl)-L-tyrosine ([18F]FET) uptake in gliomas by simultaneous MRI dynamic contrast enhanced (DCE) perfusion imaging and the impact of vascular contributions on diagnostic accuracy.

Methods:

Dynamic [18F]FET PET/MRI scans from 50 patients with glioma WHO grade 2-4 were analysed. In each patient multiple subvolumes were delineated to account for intra-patient heterogeneity. Associations of 20-40 min. [18F]FET tumour-to-background ratio (TBRmed) with median blood volume (CBV), blood flow (F), and permeability (Ki) within 134 lesion subvolumes were investigated in linear mixed models. Also, associations with initial area under curve (iAUC120), time to peak (TTP) and slope (Slope20-40) from time activity curve were investigated. The influence of adjusting TBRmed for microvascular physiological parameters on the diagnos-tic accuracy for tumour recurrences was assessed in an independent dataset (n=61 lesions from 48 patients).

Results:

CBV, F and Ki individually accounted for 42%, 36% and 26%, respectively, of the overall variance in TBRmed. DCE metrics combined accounted for 49% of the total variance and for 65% of the regional variance in TBRmed. All DCE metrics were associated positively with iAUC120 and negatively with both Slope20-40 and TTP ($p<0.001$ for all). Adjusting TBRmed for microvascular effects lowered TBR by 24% on average and reduced the diagnostic accuracy (ROC AUC) from 0.90 to 0.77 in the test dataset.

Conclusions:

Microvascular properties may contribute to a considerable fraction of the clinical [18F]FET measures in patients with gliomas, and contribute positively to diagnostic performance of [18F]FET PET imaging.

Oral Communication Session 4: Amino-acid and neurotransmitter systems visualized

CO4.9

Enhancing PitNET Diagnosis: The Role of [18F]FET PET

Valerie De Meulenaere (1), Bruno Lapauw (2), Frank Dewaele (3), Thibaut Van Zele (4), Eva Genbrugge (1), Donatienne Van Weehaeghe (1)

(1) Department of Radiology and Nuclear Medicine, Ghent University Hospital, Ghent, Belgium (2) Department of Endocrinology, Ghent University Hospital, Ghent, Belgium (3) Department of Neurosurgery, Ghent University Hospital, Ghent, Belgium (4) Department Otorhinolaryngology, University Hospital Ghent, Ghent, Belgium. •Eva Genbrugge and Donatienne Van Weehaeghe equally contributed to this work.

Introduction

Pituitary neuroendocrine tumours (PitNETs) are the second most common intracranial neoplasms. Magnetic resonance imaging (MRI) is the standard imaging modality, but some lesions remain challenging to detect. O-(2'[18F]fluoroethyl)-L-tyrosine ([18F]FET) positron emission tomography (PET) provides complementary metabolic information that may enhance detection and diagnostic confidence.

Materials and Methods

We retrospectively analysed 30 patients (18F, 12M; mean age 53±16 years) with newly diagnosed (n=21), persistent (n=5) or recurrent PitNETs (n=4), scheduled for surgery. Tumours were classified as growth hormone- (n=12), ACTH- (n=8), prolactin- (n=2), TSH-secreting (n=1), or non-functioning (n=7). All patients underwent [^{18}F]FET PET/CT imaging (185 MBq) and dedicated pituitary MRI (1.5T: n=4, 3T: n=26). PET and MR images were co-registered and segmented in MIM Software. Visual concordance (0=none, 0.5=partial, 1=high), Metabolic Index (MI=SUVmax/SUVmean cortex, cfr. glioma), and time–activity curves (TACs) were evaluated.

Results

[18F]FET PET detected all MRI-positive lesions (sensitivity 100%) and identified one MRI-negative lesion. Uptake was observed in both functioning and non-functioning PitNETs. Visual concordance between PET and MRI was high (score 1) in most cases (60%), with partial agreement (score 0.5) in the remainder (40%) due to cystic components, heterogeneous uptake or resolution limits. Mean MI was 2.4±0.4, slightly higher in functioning (2.5±0.4) compared to non-functioning tumours (2.3±0.3). Importantly, MI did not differ between PitNETs with partial cystic components and those without, indicating that limited cystic components do not comprise tracer uptake. By clinical status, MI was 2.5±0.4 in newly diagnosed, 2.7±0.2 in persistent, and 2.2±0.5 in recurrent lesions, suggesting slightly lower uptake in recurrent cases. Dynamic analysis showed predominantly descending TAC profiles (n=27), independent of hormonal activity; two were stable, and one excluded due to motion artifacts. No significant TAC differences emerged between subtypes.

Conclusion

[18F]FET PET can aid in detection and localisation of PitNETs. Interestingly, [18F]FET PET was positive both in functioning and non-functioning PitNETs. Future research is needed to validate these findings.

Oral Communication Session 5: Neuroimaging potpourri: a bit of everything

CO5.1
Brain FDG-PET, guiding treatment in a complex case

Sarah Herdewyn, Donatienne Van Weehaeghe
Ghent University Hospital

Introduction:

A woman was referred to our center because of subacute cognitive, neuromuscular and visual symptoms. Extensive and time-consuming investigations could not immediately pinpoint the cause and immunosuppressive therapy was started given the differential diagnosis. Brain FDG-PET turned out to be invaluable in guiding treatment in this case.

Case description:

A 55 year old woman was transferred to our center because of subacute onset of vision and memory loss, anorexia, tingling and weakness in the limbs. Her medical history included a mamma carcinoma in situ a decade earlier and burn-out in the months prior.

Clinical exam showed a severe amnestic syndrome, proximal leg weakness and sensory loss in the feet. Extensive work-up included MRI of the brain and spinal cord, auto-immune and paraneoplastic antibodies, lumbar puncture, EEG, ENMG, ophthalmology review, FDG-PET whole body and brain and genetic testing. FDG-PET of the brain was markedly abnormal with a diffuse hypometabolism, mostly frontal and at the precuneus, most in keeping with an encephalitis or the combination of Alzheimer's dementia with Amyotrophic Lateral Sclerosis. ENMG showed a sensorimotor polyradiculoneuropathy; ophthalmology review an atrophic ganglion cell layer; cerebrospinal fluid very high neurofilament light (and heavy) chain. Based on the initial tests results, an auto-immune or paraneoplastic limbic encephalitis and polyradiculoneuritis was suspected and immunotherapy was started: first high dose steroids, then plasma-exchange. This while awaiting additional results, that eventually could not confirm nor reject the initial diagnosis. This treatment had a modest effect, so steroids were discontinued, after which the patient reported deteriorating. She was then re-admitted to consider a second round of plasma-exchange. However, since the follow-up FDG-PET of the brain showed a normalization of the metabolism, further therapy was not pursued. After discussion with (international) peers, a toxic cause was found to be the most likely explanation for the symptoms. The triggering agent was never identified.

Conclusion:

FDG-PET of the brain, although considered an expensive test, can guide important treatment decisions in complex, unsolved cases.

Oral Communication Session 5: Neuroimaging potpourri: a bit of everything

CO5.2

PET reconstruction harmonisation using a Hoffman phantom for longitudinal plausibility in an Alzheimer's study

Boniface Hugo (1)(2)(3), Maisonobe Jacques-Antoine (2)(4), Chupin Marie (1), Kas Aurelie (1)(2)(4), Trebossen Regine (3)(5), Soret Marine (1)(2)(4)
(1) CATI, US52-UAR2031, Paris ; (2) LIB, U1146-UMR7371, Paris ; (3). Baobab, NeuroSpin, Gif-sur-Yvette ; (4). Service de Médecine Nucléaire, GH Pitié-Salpêtrière, Paris ; (5). France Life Imaging, Institut Frédéric Joliot, Gif-sur-Yvette

Introduction:

Variability among PET scanners can introduce significant bias in longitudinal neuroimaging studies. To address this, we propose harmonising brain PET reconstructions parameters using a Hoffman phantom, applied between an analog PET/CT and a digital PET/MR scanner for a longitudinal Alzheimer's biomarkers study.

Methods:

First, a Hoffman3D phantom was acquired on a PET/CT Gemini GXL (Philips) without time-of-fight (TOF) capability and a PET/MR Signa (GE) with TOF capability. Multiple PET/MR reconstructions were performed with OSEM algorithm, varying iteration and subset numbers, post-filtering size, without TOF and point-spread-function (PSF) corrections. The harmonised reconstruction (PETharmo) was selected to minimize differences with reference PET/CT reconstruction (PETref) based on grey-to-white-matter ratio, contrast-to-noise ratio and spatial resolution. Second, eighty cognitively unimpaired older adults (aged 75.3±3.0 years) underwent 18F-florbetapir PET/CT at inclusion and PET/MR at follow-up (mean interval: 9.2±0.6 years). PET/CT were reconstructed using reference parameters (PETref) while PET/MR were reconstructed using both previously determined and clinical parameters (PETharmo and PETclinical, respectively). Centiloid values (CL) were computed for each reconstruction.

Results:

Reconstruction parameters were: (i) PETref: LOR-RAMLA, 10 iterations, relaxation parameter 0.5, without TOF or PSF; (ii) PETharmo: 10 iterations, 32 subsets, 5mm post-filtering without TOF or PSF; and (iii) PETclinical: 8 iterations, 28 subsets, 3mm post-filtering with TOF and PSF.

The mean CL change between PETclinical and PET/MR was −19.5±7.7 and −13.3±7.3 in amyloid-negative subjects (n=52, CL<17), and 22.3±12.6 and 17.6±12.8 in amyloid-positive subjects (n=28, CL>17), for PETclinical and PETharmo respectively.

Conclusion:

In cognitively unimpaired older adults, the difference in centiloid values over a 9-year longitudinal follow-up is minimized through harmonized reconstruction. This work highlights the critical role of this step for longitudinal studies involving different PET scanner generations.

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CO5.3
Current Trends and Challenges in Clinical Neuroimaging in Cameroon

Ekotto Steacy Brenda
(1) Department of Radiology, Douala General Hospital, Cameroon (2) Delya Medical Imaging and Consulting, Douala, Cameroon (3) Department of Medical Sciences, University of Douala, Cameroon

INTRODUCTION

Neuroimaging plays a crucial role in the diagnosis and management of neurological diseases. In Cameroon, the rising incidence of cerebrovascular accidents, head trauma, and brain tumors has significantly increased the demand for advanced brain imaging. However, the practice remains limited by the lack of modern equipment, high examination costs, and the scarcity of trained specialists. This study aims to assess the current state of clinical neuroimaging in Cameroon and to identify the major challenges to its development.

METHODS

A descriptive cross-sectional study was conducted from January to September 2025 in five referral hospitals equipped with CT and MRI scanners in Douala and Yaoundé. Data were collected through questionnaires, on-site observations, and interviews with radiologists, neurologists, and imaging technicians. Quantitative and qualitative analyses were performed using SPSS software and a thematic approach, respectively.

RESULTS

Findings indicate that 80% of the facilities primarily use computed tomography (CT), while only 20% have access to functional MRI. The main indications were stroke (45%), head trauma (25%), and brain tumors (18%). The most common challenges reported were inadequate equipment maintenance (28%), frequent technical breakdowns (32%), and limited continuous training (40%). Nonetheless, the gradual introduction of teleradiology is improving diagnostic accessibility.

CONCLUSIONS

Clinical neuroimaging in Cameroon is progressing but remains constrained by structural and human resource challenges. Strengthening infrastructure, enhancing specialized training, and fostering international cooperation could significantly improve diagnostic capacity and the quality of care. Further research is needed to adapt technological innovations to the African context.

Oral Communication Session 5: Neuroimaging potpourri: a bit of everything

CO5.4

Frontal meningoencephalocele as a cause of super-refractory status epilepticus: a unique case report

K. Van Rooy, E. Van Haute, F. Dewaele, A. Meurs, D. Van Roost, P. Boon
1Department of Neurology, Ghent University Hospital, Belgium AND Department of Neurosurgery, Ghent University Hospital, Belgium

Purpose:

Meningoencephalocele is defined as the herniation of brain tissue through a defect in the skull. It is known to cause focal epilepsy, particularly when located in the temporal lobe. To our knowledge, this is the first reported case of a patient developing status epilepticus (SE) due to an encephalocele.

Method:

We present a case involving a previously healthy 31-year-old woman, at 32-weeks of gestation, who experienced sudden-onset recurrent bilateral tonic-clonic seizures.

Results:

The patient presented at the emergency room with new onset recurrent bilateral tonic-clonic seizures. Upon admission, the electroencephalogram (EEG) showed epileptic discharges originating from the right frontal lobe and spreading to both hemispheres. Magnetic Resonance Imaging (MRI) of the brain revealed herniation of the right inferior frontal gyrus into the anterior ethmoid sinus, with a corresponding bone defect. Despite receiving treatment with four anti-seizure medications (ASM), the patient needed to be sedated and intubated. She developed focal to bilateral convulsive super-refractory status epilepticus (SRSE), which necessitated an acute Caesarean section that was performed without complications. After three additional days of optimizing ASM and escalating sedation, the EEG no longer showed epileptic activity. Ultimately, she was discharged from the hospital on a maintenance regimen of four ASM; since then, she has remained seizure-free. Approximately six months later, the bone defect was closed endoscopically and the herniating part of the frontal cortex was resected, given the risk of infection and recurrent seizures. The patient has remained seizure-free under treatment with one ASM.

Conclusion:

This is the first case report demonstrating that SE can arise from an encephalocele. Notably, the encephalocele was located in the frontal lobe and resulted in SRSE. In summary, an encephalocele can not only lead to seizures but can also be the cause of a first presentation of SE, including SRSE, in a previously healthy patient.

Oral Communication Session 5: Neuroimaging potpourri: a bit of everything

CO5.5

Feasibility of Transcranial Ultrasound Stimulation (TUS) to the M1 hand area with MRI-guided targeting and a flexible water-balloon coupling system

Lara Hogeveen, Paul Boon, Kristl Vonck, Lisa Van Thuyne
Ghent University Hospital

Introduction:

Accurate acoustic coupling is critical for Transcranial Ultrasound Stimulation (TUS), as even small air inclusions can markedly reduce transmission efficiency. Gel-based coupling pads may shift during placement and require careful inspection for sub-pad air bubbles, particularly over curved scalp regions. To address these limitations, we performed the first-in-human TUS application using a flexible water-balloon coupling system designed to maintain a stable column of degassed water and conform uniformly to scalp curvature.

Methods:

The motor hand knob was localized using a structural brain MRI for neuronavigation-guided targeting. A custom water-balloon interface (Brainbox NeuroFUS Pro) was mounted to the transducer using a 1-cm plastic ring covered by a flexible membrane. Degassed water was introduced via inflow/outflow tubing to minimize bubble formation. A layer of ultrasound gel was applied to the scalp to ensure membrane–scalp coupling, without the need for a gel pad. Coupling integrity, presence of visible air pockets, and transducer stability were monitored.

Results:

Stable, air-free coupling was maintained throughout the procedure. The flexible membrane adapted well to the curved scalp. A minor initial water leakage occurred during positioning but was resolved using a small amount of lubricant. The fixed 1-cm water column represents a geometric constraint, but did not limit targeting of this superficial cortical region. Dual-channel NeuroFUS allowed adjustment of focal depth.

Conclusions:

This first-in-human case demonstrates that a flexible degassed-water balloon coupling system can provide reliable and stable acoustic coupling for TUS targeting of the M1 hand region, supporting its feasibility for future cortical neuromodulation studies.

Oral Communication Session 5: Neuroimaging potpourri: a bit of everything

CO5.6

Unsupervised clustering for non-invasive TSPO PET imaging of neuroinflammation

Marina Rodriguez Rodriguez; Sabine Deprez; Koen Van Laere; Michel Koole
UZ/KU Leuven, Belgium

Introduction:

Quantification of neuroinflammation with TSPO PET imaging requires the identification of brain regions with minimal specific TSPO binding, which can serve as reference regions for non-invasive quantification. Supervised Clustering Analysis (SVCA) is commonly used to classify voxels into (typically) four predefined kinetic classes: low-binding gray matter, high-binding gray matter, white matter, and blood. However, this approach requires MRI scans to provide anatomical masks, adding complexity and potential errors due to imperfect MRI segmentation and PET-MRI co-registration. To overcome these limitations, the aim of this study is to introduce a fully unsupervised, data-driven alternative for reference region identification that does not require anatomical information and predefined kinetic classes.

Methods:

In the proposed framework, functional principal component analysis (FPCA) is applied to transform each voxel's time-activity curve (TAC) into a feature vector that captures the dominant modes of variation in the tracer kinetic profile. These vectors are then used as inputs to a Gaussian Mixture Model (GMM) enhanced with a spatial prior to promote anatomically coherent clustering. Each voxel is subsequently assigned to one of four clusters based solely on its kinetic behavior, and the time-activity curves within each cluster are averaged. The cluster displaying the most temporally stable average time- activity curve, and thus the lowest degree of specific uptake, is then selected as the reference region, representing voxels with minimal TSPO binding.

Results:

The reference TACs for a set of patients were computed using both methods and compared using several metrics. The Pearson correlation coefficient was 0.92, and the relative difference in area under the curve was 4%. In addition, Logan graphical analysis was performed for each patient using both reference TACs. The resulting BPnd values were highly consistent with an average relative difference of only 1.6% across all voxels and all patients.

Conclusion:

By capturing key properties of TSPO PET TACs, this approach enables fully PET-based reference-region identification, reducing reliance on MRI-based anatomical masks and predefined kinetic classes. This broadens applicability across studies and across TSPO PET tracers, since it does not require arterial blood sampling, MRI data, or prior tracer-specific knowledge of kinetic behavior.

Oral Communication Session 5: Neuroimaging potpourri: a bit of everything

CO5.7

First clinical experiences with the ultra-fast time-of-flight BIOGRAPH One next generation hybrid PET/MRI system.

Otto M. Henriksen, Kirsten Korsholm, Annika Loft, Johanna M. Hall, Annika R. Langkilde, Vibeke A. Larsen, Thomas S. Kristensen, Caroline Ewertsen, Frederikke E. Høi-Hansen, Patrick M. Lehmann, Karen Kettless, Flemming L. Andersen, Thomas L. Andersen , Ian Law
Rigshospitalet, Copenhagen, Denmark

Introduction:

We report on the first clinical experience with the Siemens BIOGRAPH One next generation PET/MRI scanner for brain imaging across multiple tracers.

Methods:

In a clinical trial for conformity assessment a total of 29 brain scan were performed on the BIOGRAPH One PET/MRI following standard clinical PET/CT (n=22) or first-generation PET/MRI (Biograph mMR, n=7) using [18F]FDG (n=5), [18F]FE-PE2I (n=10), [18F]FET (n=4) or [68Ga]Ga-DOTATOC (n=10). PET image quality, image noise and tracer specific clinical PET metrics were compared with the clinical scan.

Following clinical implementation, the DeepDixon synthetic CT trained and validated for the Siemens mMR system was implemented directly (without transfer learning) and compared to results using vendor MRAC and sequential PET/CT imaging in 70 Brain PET/MRI [18F]FDG scans in patients referred for suspected neurodegenerative disorders.

Results:

In the clinical trial PET image quality was rated as good or very good in 90% of scans and as equal or better compared to the clinical scan in all scans. Diagnoses were rated as comparable in 98% of readings. SUVr showed expected regional bias in brain imaging. Image noise was superior to that of first-generation PET/MRI despite imaging on the BIOGRAPH One PET/MRI performed last. Fair agreement of [18F]FE-PE2I putamen-caudate ratios and of FET and [Ga68]Ga-DOTATOC tumour metrics were observed.

In clinical scans directly transferred DeepDixon synthetic CT resulted in frequent and gross errors in AC μ-maps and associated PET reconstructions.

Conclusions;

The BIOGRAPH One PET/MRI scanner constitutes a major improvement over its first-generation predecessor and holds promise for broader clinical and research applications. Accurate MR based attenuation correction remains an issue of concern.

In the talk a general overview of the scanner specifications as well as the existing challenges and opportunities of the system will be presented. Also results from retrained DeepDixon synthetic CT solution will be presented.

Oral Communication Session 5: Neuroimaging potpourri: a bit of everything

CO5.9

Effects of Voxel Size, VOI Dimensions, and PSF Correction on PET IDIF Accuracy in a Carotid Phantom as Measured with the NeuroExplorer

Valentina Turmacu, Koen Van Laere, Michel Koole
KU Leuven

Introduction:

An accurate image-derived input function (IDIF) is vital for non-invasive quantitative brain PET kinetic modeling. Segmenting carotid arteries is challenging due to resolution limits, partial-volume effects (PVE), and uncertainties in VOI placement. We assessed how point-spread function (PSF) correction, voxel size, and VOI dimension affect recovered PET activity concentrations in a phantom with carotid-like tubes across varying tube-to-background activity concentration ratios as measured with the ultrahigh-performance NeuroExplorer.

Methods:

A custom PET phantom with tubes of 3mm and 5.5mm diameters, resembling mean internal and common carotid sizes, was imaged on the NeuroExplorer across tube-to-background ratios of infinity, 17.7, 5.2, 1.5, and 0.5, reconstructed at 0.5mm and 0.8mm voxel sizes, with and without PSF correction. Masks corresponding to physical tube diameters underwent skeletonization to derive geometric centerlines, which were dilated in voxel increments to form VOIs. Mean activities were computed per parameter combination, along with thresholded means, which excluded voxels below ~80% of known concentrations to mitigate PVE.

Results:

Recovery coefficients (RC = mean/true concentration) for the 3mm tube with small VOIs (0.5–1.5mm) at high ratios (>10) averaged 0.65 (0.5mm voxels, no PSF), 1.11 (with PSF), 0.62 (0.8mm, no PSF), and 1.02 (with PSF). For the 5.5mm tube, respective RCs were 0.75, 0.84, 0.74, and 0.88. Expanded VOIs reduced RCs in high ratios due to spill-out but elevated them in low ratios due to spill-in. PSF correction augmented RCs by 20–70% in high ratios yet induced overestimation in the 3mm tube. Thresholding augmented RCs to 0.88–1.01 in high ratios but had limited benefit in low ratios. Smaller voxels improved RCs towards unity (5–15%).

Conclusion:

Smaller voxels and PSF correction enhanced IDIF accuracy in high-contrast conditions, whereas centerline-based VOIs ensure reproducible sampling. Without PSF, activity concentration is consistently underestimated, regardless of the ratio, whereas PSF RCs fluctuate inconsistently with the background. The NeuroExplorer enables feasible carotid IDIF with very good RCs, although further optimization is required: small VOIs and thresholding mitigate spill-out in high ratios, whereas larger VOIs equilibrate recovery and spill-in in low

ratios. These insights inform clinical methodologies, mitigating bias in neuroimaging kinetic parameters.