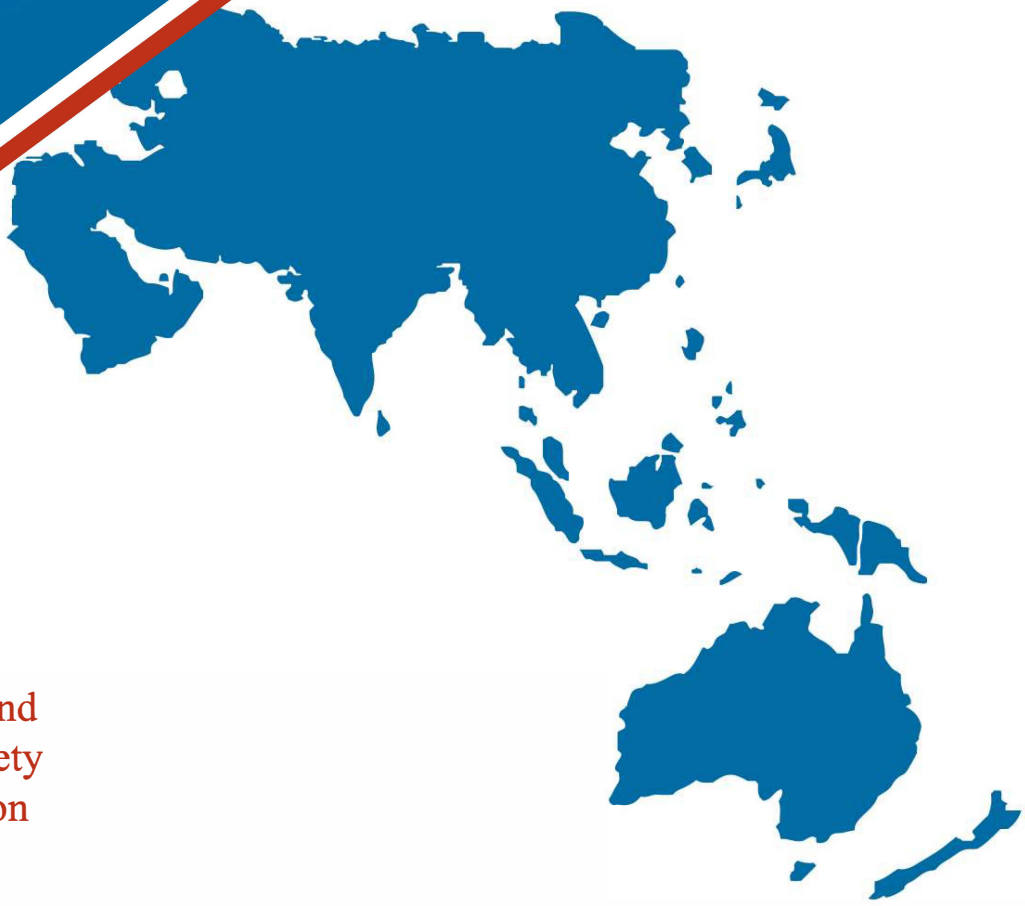
Asian and Oceanian Parkinson's Disease and Movement Disorders Congress

March 21-23, 2025

Tokyo, Japan



International Parkinson and Movement Disorder Society
Asian & Oceanian Section

Late-Breaking Abstracts

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9th Asian and Oceanian Parkinson's Disease and Movement Disorders Congress®
2025 Late-Breaking Abstracts

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LBA-2 Integrating and gait, eye movement analysis and resting-state functional magnetic resonance imaging to establish a diagnostic model for cognitive dysfunction in Parkinson's disease
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LBA-3 Temporal Relationship Between PET and MRI Findings in the Putamen of MSA Patients
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DM. Au, HY. Wong, LKW. Cheng, YL. Cheng, HF. Or, KY. Mok, FCF. Ip, KW. See, GHF. Chan, TL. Poon, YF. Cheung, AK. Fu, NY. Ip *(Hong Kong, Hong Kong)*

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JY. Lee, HJ. Kim, TB. Ahn, JM. Kim, JW. Cho, D. Yoo, JH. Shin, R. Kim, B. Jeon *(Seoul, Korea)*

LBA-8 The effect and limits of unilateral magnetic resonance-guided focused ultrasound pallidotomy for Parkinson's disease
Y. Osakada, H. Hirabayashi, T. Yamashita, H. Ohnishi, H. Ohnishi, H. Ishiura *(Okayama, Japan)*

LBA-9 Noninvasive Temporal Interference Subthalamic Stimulation for Treating Motor Symptoms in Parkinson's Disease
CH. Yang, YX. Xu, U. Ziemann, CC. Zhang, Y. Liu *(Shanghai, People's Republic of China)*

LBA-10 The Regional Burden of Parkinson's Disease in Kazakhstan 2014–2021: Insights From National Health Data
R. Akhmedullin, A. Gusmanov, G. Zhakhina, B. Crape, T. Aimyshev, Y. Semenova, G. Kyrgyzbay, A. Gaipov *(Astana, Kazakhstan)*

LBA-11 Antiepileptic Drugs and Parkinson's Disease: A Meta-Analysis of Existing Evidence
R. Akhmedullin, D. Kalinina, A. Sarria-Santamera, D. Almabayeva, R. Kaiyrzhanov *(Astana, Kazakhstan)*

LBA-12 Deep brain stimulation of the posterior subthalamic area and the subthalamic nucleus in tremor-dominant Parkinson's disease: a randomized, crossover trial
ZY. Lin, ZT. Zeng, YX. Pan, P. Huang, YY. Tan, DY. Li *(Shanghai, People's Republic of China)*

LBA-1 Association between plasma Phosphorylated tau 217 levels and Parkinson's disease

YY. Zhu, XL. Yang *(Kunming, People's Republic of China)*

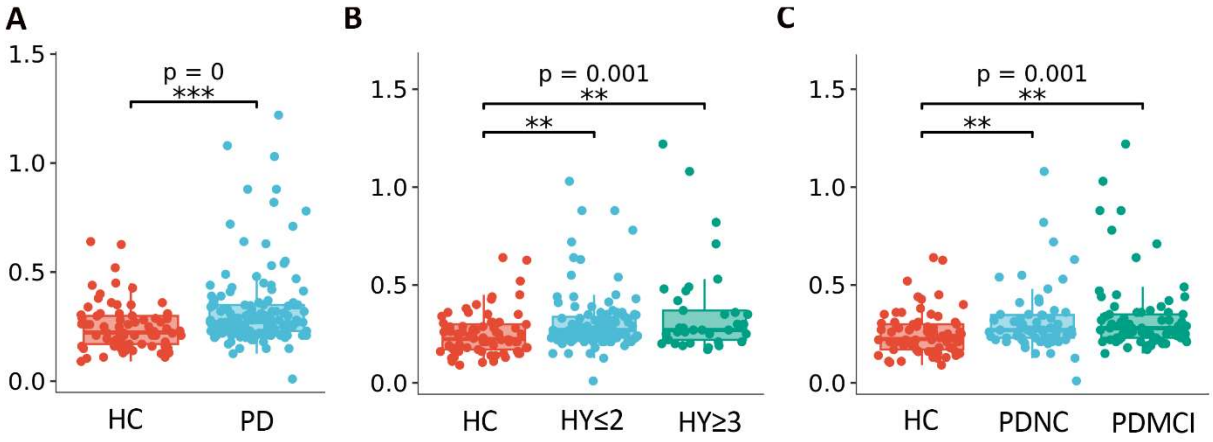
Objective: This study investigated the potential association between plasma levels of p-tau217 and patients suffering from PD in P.R. China.

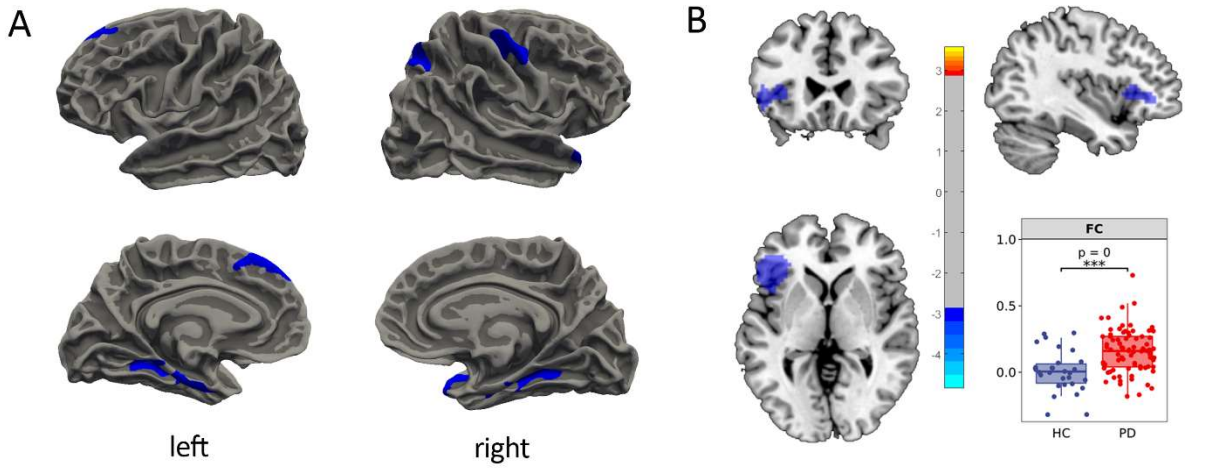
Background: The relationship between plasma levels of Phosphorylated tau217 (p-tau217) and Parkinson's disease(PD) is unclear.

Method: A total of 144 PD patients and 72 age - and gender-matched healthy controls (HC) were recruited from the Department of Neurology, the First Affiliated Hospital of Kunming Medical University. The general clinical data, scales, plasma and imaging data (T1 and Resting state functional nuclear magnetism(Rs-fMRI)) of all subjects were collected. Plasma p-tau217 was measured using single molecule array (Simoa). p-tau217 levels were analyzed between the groups of HC and PD, and between PD subgroups (PD with normal cognitive(PDNC) and PD with mils cognitive impairment (PDMCI), mild-moderate and severe PD). Spearman correlation analysis was used to analyze the correlation between p-tau217 and cortical thickness and clinical scales in PD patients. Combined with the Rs-fMRI data, the brain regions with significant correlation with p-tau217 were used as the areas of interest to analyze the changes of functional connectivity (FC) between PD group and HC group. Receiver operator characteristic curve analysis was used to evaluate the ability of p-tau217 and FC to distinguish between HC and PD patients, and the area under the curve (AUC) was calculated.

Results: Compared with the HC group（0.25±0.11), the PD group（0.32±0.18）had a higher p-tau217 level, and the difference was statistically significant (Figure1.A). In the PD subgroup, There was no significant difference in p-tau217 levels between the mild-moderate PD group and the severe PD group (Figure1.B), and no significant difference in p-tau217 levels between the PDNC group and the PDMCI group (Figure1.C). In the PD group, p-tau217 level was significantly negatively correlated with cortical thickness of bilateral fusiform gyrus, left superiorfrontal gyrus, right precentral gyrus, right superiorparietal gyrus, and right superiortemporal gyrus (Figure2.A), but not with Part II of the Unified Parkinson's Disease Rating Scale, Montreal cognitive scale, Hamilton anxiety scale, Hamilton depression scale, and Rapid Eye Movement Sleep Behavior Disorder screening questionnaire. Compared with the HC group, the FC values of the left fusiform gyrus and left inferiorfrontal gyrus were increased in the PD group(Figure2.B), and there were no significant differences in other related brain regions. ROC results showed that the area under the curve of p-tau217 to distinguish the PD group from the HC group was 0.53, and the AUC of the FC value of the left fusiform gyrus and left inferiorfrontal gyrus was 0.55, and the AUC of the combination of the two was 0.76(Figure3).

Conclusion: p-tau217 combined with FC can improve the ability to identify PD patients from HC, suggesting that tau deposition may play a certain important role in the pathogenesis of PD.


A
B
C
p = 0
***
p = 0.001
**
**
p = 0.001
**
**
1.5
1.0
0.5
0.0
HC
PD
HY≤2
HY≥3
PDNC
PDMCI


A
B
left
right
FC
p = 0
***
1.0
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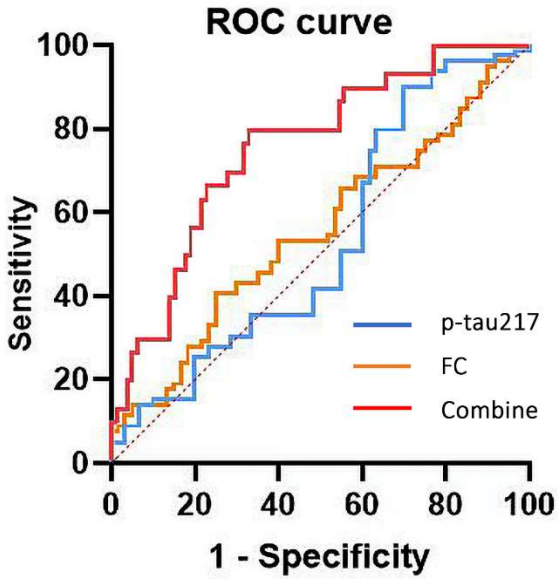
HC
PD


ROC curve
Sensitivity
1 - Specificity
100
80
60
40
20
0
0
20
40
60
80
100
p-tau217
FC
Combine

LBA-2 Integrating and gait, eye movement analysis and resting-state functional magnetic resonance imaging to establish a diagnostic model for cognitive dysfunction in Parkinson's disease

CY. Liang, XL. Yang *(Kunming, People's Republic of China)*

Objective: With the discovery of the potential role of gait, ocular dyskinesia, and resting-state functional magnetic resonance imaging in the identification of PD-MCI, we aimed to construct a diagnostic model for cognitive impairment in Parkinson's disease that combines dual-task gait, single-target, and multi-target ocular dyskinesia, and resting-state functional magnetic resonance imaging, and to assess its feasibility, applicability, and advantages in the clinical setting.

Background: Parkinson's disease is a chronic progressive neurodegenerative disease, in which many non-motor symptoms occur in addition to typical motor symptoms, among which cognitive impairment is more common and may occur at any stage of the disease, increasing the risk of early progression to dementia and seriously affecting patients' quality of life. In recent years, research has focused on Parkinson's disease mild cognitive impairment (PD-MCI), with the expectation that early identification, interventional treatment and ongoing management will lead to significant improvement in patient prognosis.

Method: We recruited 100 patients with Parkinson's disease and 20 healthy controls, who were divided into a Parkinson's disease mild cognitive dysfunction group (n=50) and a Parkinson's disease normal cognitive function group (n=50) based on MMSE and MoCA scores, and examined 8 eye movement metrics each in the single-target and dual-target conditions, 3 in the Eyelink eye movement meter and wearable quantitative assessment system for movement and gait, 3 in the movement paradigms and 33 gait metrics in dual-task conditions, and analyzed the resting-state functional magnetic resonance imaging system functional connectivity density (FCD), low-frequency amplitude (ALFF), and fractional low-frequency amplitude (fALFF), to obtain brain regions of the brain with the intensity of neural activity. Finally, feature extraction, modeling as well as validation are performed by supervised machine learning.

Results: In the single-target eye movement task, there were significant differences in the mean duration, accuracy of gaze in the PDMCI group compared to the PDNC group. In the multi-target eye movement task, there was a significant difference in the mean size of the sweep, duration per trial, accuracy, and reaction time of the PDMCI group compared to the PDNC group. There were significant differences in step speed, maximal right and left calf forward swing angle, maximal right and left calf back swing angle, and mean angular velocity during steering in the dual-task timed-up walk, and dual-task narrow path in the PDMCI group compared to the PDNC and HC groups. In dual-task turning, the average length of the turning process and the average angular velocity of the full turning process were significantly different among the three groups. In the resting-state MRI data, compared with the PDNC group, the FCD values of some brain regions were lower (e.g., right medial orbitofrontal gyrus, left thalamus) and some were higher (e.g., right posterior cerebellar lobe, right precuneus) compared with the PD-MCI group. Compared with the HC group, FCD and fALFF of all differential brain regions derived in this study were decreased in PDMCI, e.g., left posterior cerebellar lobe, right lingual gyrus, right precuneus, right paracentral lobule.

Conclusion: We demonstrated alterations in the intensity of eye movement and gait deficits as well as neural activity in the corresponding brain regions in Parkinson's disease patients, which is expected to

improve the prediction of PDMCI patients by better distinguishing between PDMCI and PDNC patients through multi-modal, multi-featured machine learning studies.

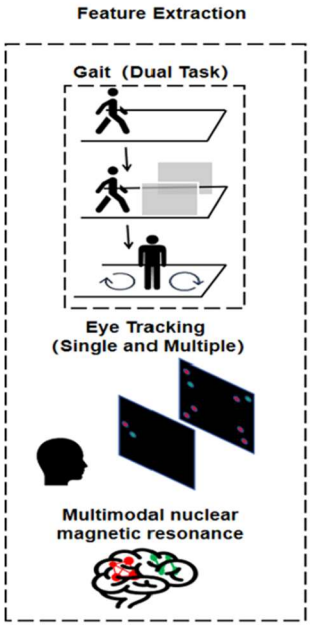


Fig.1 Overview diagram of dual-task gait, single/multi-target eye movement and resting state MRI procedures

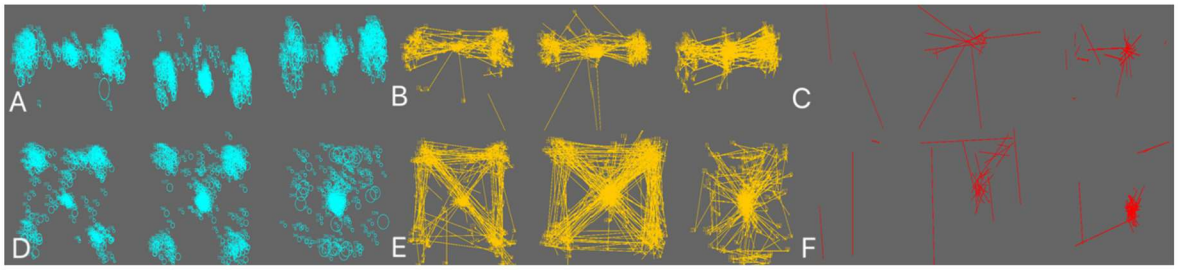


Fig.2 Single-target and multi-target eye-tracking with views

A. Single-target eye-tracking gaze points (left: PDMCI, center: PDNC, right: HC, the rest of the pictures are in this order), **B.** Single-target eye-tracking sweeps, **C.** Single-target eye-tracking blinks, **D.** Multi-target eye-tracking gaze points, **E.** Multi-target eye-tracking sweeps, **F.** Multi-target eye-tracking blinks. One subject was randomly selected from the PDMCI, PDNC, and HC3 groups to observe gaze point, sweep, and blink visualization in single-target eye tracking (20 trials in total) and multi-target eye tracking (30 trials in total). The number of blinks was significantly reduced in PDMCI patients compared with PDNC patients (C, F). Sweeps were disorganized in PDMCI and PDNC patients compared with HC, which consisted of most of the sweeps emanating from the center of the visual field（E）.

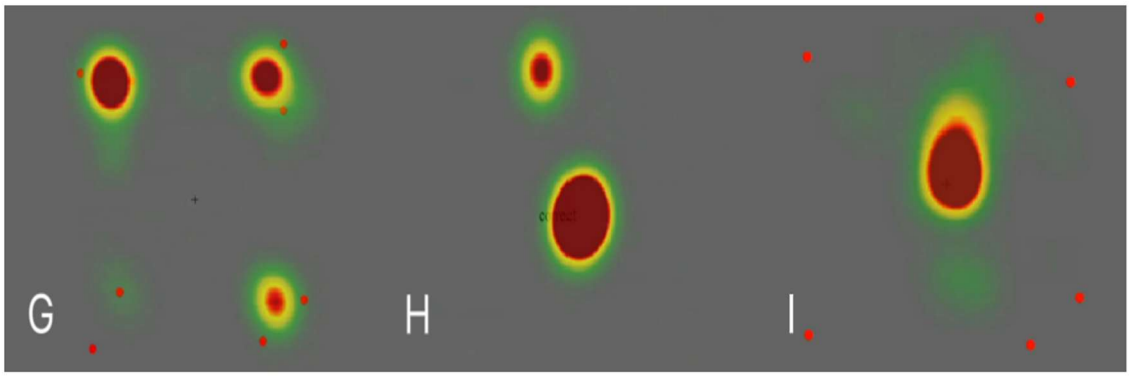


Fig.3 Multi-target eye tracking visualization heatmap

One subject was randomly selected from the PDMCI (G), PDNC (H), and HC (I) groups to observe the heat maps of multi-target eye tracking (a total of 30 trials). Compared with the HC group, patients with PDMCI and PDNC had a more fragmented attentional heat map and could not maintain the center of the visual field for a long time.

Table 1 Comparison of gait characteristics among PD-MCI,PD-NC and HC groups

Task	Features	PD-MCI (n=50)	PD-NC (n=50)	HC (n=20)	p value
Timed up and go	Walk Speed(m/s),mean±SD	0.40±0.14[bc]	0.56±0.23[ac]	0.65±0.12[ab]	**<0.001**
	Cadence(steps/min),mean±SD	97.82±14.12[c]	99.68±13.58[c]	108.91±11.97[ab]	**0.009**
	Swing(%),median(IQR)	38.06(35.73,39.98)	39.31(37.86,40.97)	39.94(37.93,40.19)	**0.058**
	Stance(%),median(IQR)	61.94(60.02,64.27)	60.69(59.03,62.14)	60.06(59.81,62.07)	**0.058**
	Shank - Forward Swing Max(degree),mean±SD	12.20±6.69[bc]	16.77±8.07[ac]	22.32±4.53[ab]	**<0.001**
	Shank - Backward Swing Max(degree),median(IQR)	-37.86(-42.09,-34.65)[bc]	-42.36(-47.38,-39.78)[ac]	-47.91(-50.83,-43.61)[ab]	**<0.001**
	Phase Coordination Index(%),median(IQR)	8.63(6.06,13.25)	8.05(5.40,11.59)	6.70(4.63,8.57)	**0.074**
	Coordination (%),median(IQR)	0.86(-3.09,3.93)	0.24(-1.51,3.18)	-1.65(-5.07,2.05)	**0.185**
	Trunk - Sway Max(degree),median(IQR)	3.75(3.14,4.49)[c]	4.21(3.34,5.19)[c]	5.43(3.99,6.98)[ab]	**<0.001**
	Arm - Forward Swing Max(degree),median(IQR)	30.54(25.63,36.41)	31.70(24.40,35.75)	33.68(27.72,42.18)	**0.252**
	Arm - Backward Swing Max(degree),median(IQR)	15.20(9.73,20.88)[c]	13.51(5.27,18.61)[c]	-3.28(-6.67,2.04)[ab]	**<0.001**
	Arm - Swing Range (degree),median(IQR)	13.13(7.23,20.10)[c]	15.00(9.24,24.23)[c]	38.34(25.56,49.18)[ab]	**<0.001**
	Arm - Symbolic Symmetry Index(%),median(IQR)	37.34(33.56,41.76)	37.79(34.37,41.08)	35.80(27.87,38.62)	**0.076**
	Duration(sec),median(IQR)	3.21(2.64,4.81)[c]	2.92(2.17,3.65)[c]	1.70(1.50,2.15)[ab]	**<0.001**
	Mean Angular Velocity(degree/sec),mean±SD	55.35±18.41[bc]	66.00±25.08[ac]	108.61±27.54[ab]	**<0.001**
Narrow passage	Walk Speed(m/s),median(IQR)	0.37(0.28,0.45)[bc]	0.49(0.31,0.66)[ac]	0.55(0.48,0.74)[ab]	**<0.001**
	Cadence(steps/min),mean±SD	96.29±13.84[c]	97.10±13.40[c]	104.53±11.31[ab]	**0.056**
	Swing(%),median(IQR)	37.64(35.34,39.92)[c]	38.80(37.00,40.11)	39.46(38.03,40.23)[a]	**0.043**
	Stance(%),median(IQR)	62.36(60.08,64.66)[c]	61.20(59.89,63.00)	60.54(59.77,61.97)[a]	**0.043**
	Shank - Forward Swing Max(degree),mean±SD	11.57±6.93[bc]	15.94±8.40[ac]	21.10±4.84[ab]	**<0.001**
	Shank - Backward Swing Max(degree),median(IQR)	-38.86(-42.61,-35.02)[bc]	-44.62(-48.26,-40.31)[ac]	-51.28(-53.60,-46.19)[ab]	**<0.001**
	Phase Coordination Index(%),median(IQR)	12.58(8.70,16.23)[c]	11.30(7.31,15.33)	9.49(7.08,11.29)[a]	**0.025**
	Coordination (%),median(IQR)	0.21(-2.53,3.39)	0.35(-1.59,3.47)	-1.39(-3.61,2.21)	**0.471**
	Trunk - Sway Max(degree),median(IQR)	3.75(3.34,4.54)[bc]	4.31(3.69,5.26)[ac]	6.53(5.60,7.59)[ab]	**<0.001**
	Arm - Forward Swing Max(degree),median(IQR)	30.85(27.59,35.73)	28.57(23.75,36.80)	34.34(24.52,40.76)	**0.337**
	Arm - Backward Swing Max(degree),median(IQR)	18.35(9.94,22.88)[c]	14.65(8.44,20.17)[c]	-0.93(-7.56,3.08)[ab]	**<0.001**
	Arm - Swing Range (degree),median(IQR)	10.95(8.44,18.65)[c]	13.28(8.54,19.08)[c]	33.29(18.38,45.82)[ab]	**<0.001**
	Arm - Symbolic Symmetry Index(%),median(IQR)	35.77(33.19,39.26)	36.76(34.28,39.48)	36.78(30.10,38.99)	**0.538**
	Duration(sec),median(IQR)	3.25(2.50,4.95)[c]	2.79(2.23,3.64)[c]	1.77(1.53,2.06)[ab]	**<0.001**
	Mean Angular Velocity(degree/sec),mean±SD	54.15±21.02[c]	64.20±28.87[c]	102.91±27.06[ab]	**<0.001**
Turn around	Turning - Average Duration(sec),median(IQR)	19.38(14.39,26.07)[bc]	15.53(11.51,19.55)[ac]	7.05(6.04,8.45)[ab]	**<0.001**
	Turning - Average Steps(step),median(IQR)	23.00(17.50,36.00)[c]	18.50(14.88,26.25)[c]	10.25(9.50,13.00)[ab]	**<0.001**
	Turning - Average Angular Velocity(degree/sec),mean±SD	39.80±16.63[bc]	53.18±20.32[ac]	105.70±28.58[ab]	**<0.001**

When comparing between the three groups, a p-value less than 0.05 indicated statistical significance compared to thePD-MCI group (denoted as "a"), PD-NC group ("b "), or HC group ("c ").PD-MCI Parkinson's disease with mild cognitive impairment, PD-NC Parkinson's disease normal cognitive, HC healthy control.

Table 2 Comparison of gait characteristics among PD and HC groups

Task	Features	PD (n=100)	HC (n=20)	p value
Timed up and go	Walk Speed(m/s),mean±SD	0.48±0.20	0.65±0.12	**<0.001**
	Cadence(steps/min),mean±SD	98.75±13.81	108.91±11.97	**0.003**
	Swing(%),median(IQR)	39.07(36.46,40.58)	39.94(37.93,40.19)	**0.172**
	Stance(%),median(IQR)	60.93(59.42,63.54)	60.06(59.81,62.07)	**0.172**
	Shank - Forward Swing Max(degree),mean±SD	14.49±7.72	22.32±4.53	**<0.001**
	Shank - Backward Swing Max(degree),median(IQR)	-40.96(-45.49,-37.07)	-47.91(-50.83,-43.61)	**<0.001**
	Phase Coordination Index(%),median(IQR)	8.21(5.82,12.36)	6.70(4.63,8.57)	**0.054**
	Coordination (%),median(IQR)	0.64(-2.35,3.50)	-1.65(-5.07,2.05)	**0.067**
	Trunk - Sway Max(degree),median(IQR)	3.89(3.25,4.93)	5.43(3.99,6.98)	**<0.001**
	Arm - Forward Swing Max(degree),median(IQR)	31.60(25.14,35.93)	33.68(27.72,42.18)	**0.099**
	Arm - Backward Swing Max(degree),median(IQR)	14.34(8.34,19.49)	-3.28(-6.67,2.04)	**<0.001**
	Arm - Swing Range (degree),median(IQR)	13.75(8.74,22.92)	38.34(25.56,49.18)	**<0.001**
	Arm - Symbolic Symmetry Index(%),mean±SD	38.08±5.67	33.73±6.50	**0.003**
	Duration(sec),median(IQR)	3.12(2.44,3.83)	1.70(1.50,2.15)	**<0.001**
	Mean Angular Velocity(degree/sec),mean±SD	60.67±22.53	104.61±27.54	**<0.001**
Narrow passage	Walk Speed(m/s),median(IQR)	0.41(0.29,0.55)	0.55(0.48,0.74)	**<0.001**
	Cadence(steps/min),mean±SD	96.69±13.56	104.54±11.31	**0.017**
	Swing(%),median(IQR)	38.14(36.39,39.95)	39.46(38.03,40.23)	**0.088**
	Stance(%),median(IQR)	61.86(60.05,63.61)	60.54(59.77,61.97)	**0.088**
	Shank - Forward Swing Max(degree),mean±SD	13.75±7.97	21.10±4.84	**<0.001**
	Shank - Backward Swing Max(degree),median(IQR)	-41.48(-45.59,-37.87)	-51.28(-53.60,-46.19)	**<0.001**
	Phase Coordination Index(%),median(IQR)	12.17(7.95,16.15)	9.49(7.08,11.29)	**0.019**
	Coordination (%),median(IQR)	0.25(-1.99,3.45)	-1.39(-3.61,2.21)	**0.220**
	Trunk - Sway Max(degree),median(IQR)	4.03(3.49,5.15)	6.53(5.60,7.59)	**<0.001**
	Arm - Forward Swing Max(degree),median(IQR)	29.61(25.02,36.33)	34.34(24.52,40.76)	**0.324**
	Arm - Backward Swing Max(degree),median(IQR)	15.57(9.50,21.17)	-0.93(-7.56,3.08)	**<0.001**
	Arm - Swing Range (degree),median(IQR)	11.99(8.44,18.99)	33.29(18.38,45.82)	**<0.001**
	Arm - Symbolic Symmetry Index(%),mean±SD	36.67±4.52	34.25±6.04	**0.041**
	Duration(sec),median(IQR)	2.97(2.40,4.26)	1.77(1.53,2.06)	**<0.001**
	Mean Angular Velocity(degree/sec),mean±SD	59.18±25.63	102.91±27.06	**<0.001**
Turn around	Turning - Average Duration(sec),median(IQR)	17.30(12.23,21.93)	7.05(6.04,8.45)	**<0.001**
	Turning - Average Steps(step),median(IQR)	21.00(15.38,33.00)	10.25(9.50,13.00)	**<0.001**
	Turning Average Angular Velocity(degree/sec),median(IQR)	43.12(33.03,62.78)	102.14(87.76,119.69)	**<0.001**

Table 3 Comparison of eye movement characteristics among PD-MCI,PD-NC and HC groups

Task	Features	PD-MCI (n=50)	PD-NC (n=50)	HC (n=20)	p value
Single target tracking	Average fixation duration,median(IQR)	622(453,820)[bc]	487(405,650)[a]	422(331,521)[a]	**<0.001**
	Average saccade amplitude, median(IQR)	2.49(2.07,2.96)	2.55(2.29,2.87)	2.58(2.07,2.98)	**0.635**
	Blink count, sum,median(IQR)	15(4,37)	17(6,38)	25(16,34)	**0.423**
	Duration, median(IQR)	8042(7259,9172)[c]	7453(7096,7841)[c]	7001(6859,7374)[ab]	**<0.001**
	Fixation count, mean±SD	13.50±4.06[c]	14.35±3.75[c]	17.01±4.97[ab]	**0.007**
	Saccade count, summedian(IQR)	245(191,314)[c]	269(199,346)	296(248,363)[a]	**0.028**
	Accuracy, sum,median(IQR)	15(12,17)[bc]	18(17,19)[a]	19(18,20)[a]	**<0.001**
	Reaction time (average), median(IQR)	1934(1195,3064)[c]	1347(991,1734)[c]	863(741,1037)[ab]	**<0.001**
Multiple target tracking	Average fixation duration, median(IQR)	521(422,630)	503(369,680)	559(367,797)	**0.752**
	Average saccade amplitude, median(IQR)	3.72(2.85,4.80)[b]	4.42(3.69,5.39)[ac]	3.73(2.60,4.55)[b]	**0.029**
	Blink count, sum,median(IQR)	20(3,58)	32(18,71)	42(26,60)	**0.060**
	Duration, median(IQR)	6915(6517,7894)[bc]	6631(6326,7049)[ac]	6236(6011,6456)[ab]	**<0.001**
	Fixation count, median(IQR)	12(11,18)	12(10,15)	11(8,16)	**0.160**
	Saccade count, sum,median(IQR)	348(290,508)	330(269,438)	292(215,461)	**0.164**
	Accuracy, sum,mean±SD	16.86±3.16[bc]	23.6±2.55[ac]	27.70±1.75[ab]	**<0.001**
	Reaction time (average), median(IQR)	1839(1351,2671)[bc]	1400(1099,1808)[ac]	924(791,1057)[ab]	**<0.001**

When comparing between the three groups, a p-value less than 0.05 indicated statistical significance compared to thePD-MCI group (denoted as "a"), PD-NC group ("b "), or HC group ("c ").

Table 4 Comparison of eye movement characteristics among PD-MCI,PD-NC and HC groups

Task	Features	PD (n=100)	HC (n=20)	p value
Single target tracking	Average fixation duration, median(IQR)	543(438,731)	422(331,521)	**0.001**
	Average saccade amplitude, median(IQR)	2.50(2.19,2.93)	2.58(2.07,2.98)	**0.805**
	Blink count, sum,median(IQR)	15(4,38)	25(16,34)	**0.295**
	Duration, median(IQR)	7645(7161,8269)	7001(6859,7374)	**< 0.001**
	Fixation count, mean±SD	13.95±3.91	17.01±4.97	**0.003**
	Saccade count, sum,mean±SD	261.50±79.69	322.60±100.39	**0.003**
	Accuracy, sum,median(IQR)	17(14,18)	19(18,20)	**< 0.001**
	Reaction time (average), median(IQR)	1539(1060,2165)	863(741,1037)	**< 0.001**
Multiple target tracking	Average fixation duration,median(IQR)	520(390,664)	559(367,797)	**0.522**
	Average saccade amplitude, mean±SD	4.21±1.19	3.86±1.79	**0.270**
	Blink count, sum,median(IQR)	29(6,64)	42(26,60)	**0.284**
	Duration, median(IQR)	6737(6375,7325)	6236(6011,6456)	**< 0.001**
	Fixation count,median(IQR)	12.22(10.24,16.40)	11(8,16)	**0.107**
	Saccade count, sum,median(IQR)	343(279,475)	292(215,461)	**0.105**
	Accuracy, sum,median(IQR)	20(17,23)	28(27,29)	**< 0.001**
	Reaction time (average), median(IQR)	1519(1157,2018)	924(791,1057)	**< 0.001**

Table 5 Statistical analysis of inter-group RStatistical analysis of inter-group Rs-fMRI features

Variable	Interblock	Brain area	MNI (x,y,z)	Voxels	T
FCD	PD-MCI < PD-NC	Cerebellum_Crus1_R	0,-84,-12	564	-5.95
		Precuneus_R	3,-51,72	972	-7.32
	PD-MCI > PD-NC	Frontal_Med_Orb_R	3,66,-12	363	6.82
		Thalamus_L	-30,-63,12	214	4.90
		Cerebellum_Crus1_L	-51,-69,-24	190	-5.52
	PD-MCI < HC	Lingual_R	12,-42,3	295	-5.77
		Precuneus_R	3,-57,66	837	-8.32
	PD-NC < HC	Lingual_L	-24,-54,-9	188	-5.09
		Cuneus_R	6,-81,21	463	-5.06
	PD < HC	Lingual_L	-24,-54,-9	1096	-6.29
		Cuneus_L	-15,-78,33	349	-8.33
ALFF	PD-NC > HC	Parietal_Inf_R	39,-48,48	52	5.40
	PD < HC	Occipital_Sup_L	-15,-93,3	54	-5.26
		Putamen_L	-21,15,-9	56	-4.58
	PD > HC	Parietal_Inf_R	39,-51,51	93	4.28
fALFF	PD-MCI < HC	Paracentral_Lobule_R	6,-27,63	17	-4.439

FCD functional connection density,ALFF low-frequency amplitude, fALFF fractional low frequency amplitude, PDMCI Parkinson's disease with mild cognitive impairment, PDNC Parkinson's disease normal cognitive, HC healthy control.

LBA-3 Temporal Relationship Between PET and MRI Findings in the Putamen of MSA Patients

YS. Kim, DG. Park, YS. Ahn, JH Yoon *(Suwan, Korea)*

Objective: To clarify the temporal relationship between MRI findings and early-phase PET imaging of the putamen in diagnosing multiple system atrophy (MSA).

Background: Diagnostic imaging plays a pivotal role in differentiating MSA from other parkinsonian syndromes. MRI often identifies hallmark features such as putaminal atrophy, increased diffusivity, and iron deposition, which reflect structural changes in the basal ganglia. FDG-PET and early-phase FP-CIT PET can detect hypometabolism or hypoperfusion, respectively, in the cerebellum and putamen. However, the temporal relationship between MRI findings and early-phase PET imaging remains unclear. This study aims to elucidate this relationship.

Method: A case-control study was conducted with 39 patients with clinically established MSA who underwent MRI and dual-phase 18F-FP-CIT PET imaging. MRI was assessed for (1) putaminal atrophy on T2-weighted images, (2) increased diffusivity on diffusion-weighted images (DWI)/apparent diffusion coefficient (ADC), and (3) decreased signal on iron-sensitive sequences. Dynamic PET was analyzed at 10 minutes (early phase) and 90 minutes (delayed phase) post-injection for radiotracer abnormalities.

Results: Of 39 patients, 13 (33%) underwent PET and MRI within a 14-day interval (concurrent imaging). Patients imaged at different times were categorized as PET first (n=19, 48.7%) or MRI first (n=7, 17.9%). Structural MRI abnormalities (atrophy, increased diffusivity, decreased signal) were seen in 32 patients (82%), early-phase PET hypoperfusion in 18 (46%), and delayed-phase PET radiotracer reduction in 27 (69%). In the concurrent imaging group, MRI had a positive rate of 92.3%, while early-phase PET showed hypoperfusion in 61.5%. For MRI-first cases, MRI positive rate was 71.4%, with early-phase PET hypoperfusion in 28.6%. For PET-first cases, MRI positive rate was 78.9%, and early-phase PET hypoperfusion was 42.1%. All patients with early-phase or delayed-phase PET involvement showed prior or concurrent putaminal MRI abnormalities, with no cases of early-phase or delayed-phase PET findings preceding MRI changes.

Conclusion: Structural MRI changes, such as increased diffusivity and iron deposition, precede early-phase PET changes in MSA. These findings suggest that neuronal injury occurs before perfusion deficits and further basal ganglia degeneration, supporting MRI as an earlier marker in disease progression for MSA-P.

LBA-4 Changes in brain perfusion in patients with drug-induced parkinsonism

HS. Yoo, YE. Sun, S. Jeon, BS. Ye, PH. Lee, CH. Lyoo *(Seoul, Korea)*

Objective: We aimed to find a characteristic pattern of brain perfusion in patients with drug-induced parkinsonism (DIP) and investigate its association with parkinsonism.

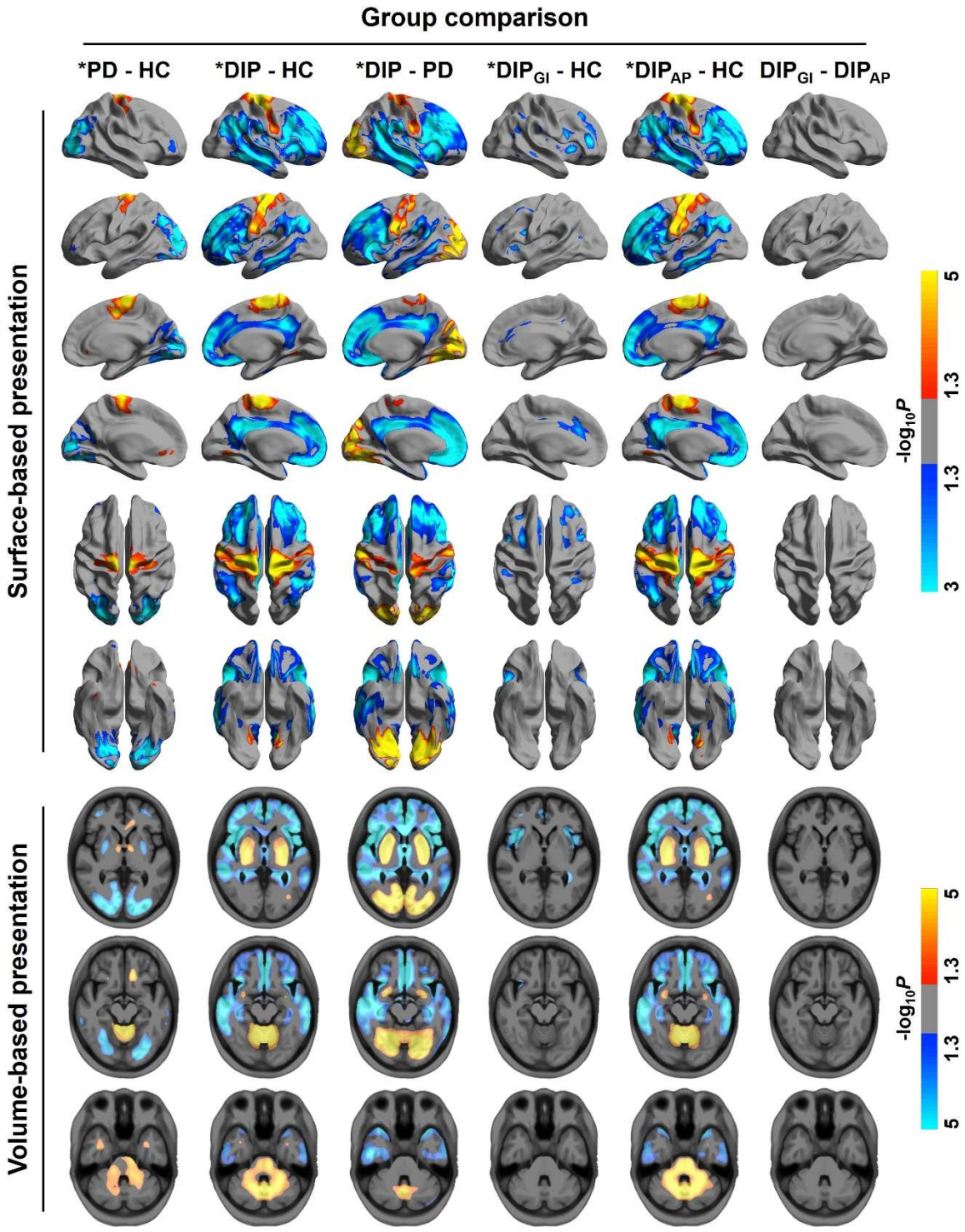
Background: DIP is the most common drug-induced movement disroder and the second most common cause of parkinsonism after Parkinson's disease (PD). It is important to diagnose DIP in patients presenting parkinsonian symptoms because, in most patients with DIP, discontinuation of the offending drugs can simply reverse the parkinsonism and bring about a good prognosis. However, the detailed pathophysiology of parkinsonism by blocking D2 receptor and disease-specific brain changes are still unknown.

Method: In this cross-sectional study, we recruited 72 patients with DIP who underwent Unified Parkinson’s Disease Rating Scale (UPDRS), brain MRI, and 18F-FP-CIT PET. An offending drug for 23 patients was gastrointestinal (GI) prokinetics (DIPGI) and that for 49 patients was anti-psychotics (DIPAP). We also enrolled 160 early and drug-naïve patients with PD and 62 healthy controls, all of whom performed brain MRI and 18F-FP-CIT PET. Early-phase 18F-FP-CIT images evaluated brain perfusion, while delayed-phase images evaluated dopamine transporter availability. We compared early-phase 18F-FP-CIT uptakes between IPD, PD, and HC groups. Then, we investigated its association with UPDRS part III total score. We calculated the expression of DIP-related perfusion pattern using w-score, compared its expression among the groups, and investigated its correlation with UPDRS part III

total score, and analyzed its diagnostic performance. Age at PET scan, sex, hypertension, diabetes mellitus, and dyslipidemia were commonly used as covariates in all analyses.

Results: Compared to healthy controls, the DIP group showed relative hypoperfusion in the prefrontal, inferior parietal, lateral temporal cortices as well as cingulate cortex and precuneus and relative hyperperfusion in the primary sensorimotor cortex and fusiform gyrus. Meanwhile, the PD group showed relative hypoperfusion in the lateral orbitofrontal, lateral occipital, and medial occipital cortices and relative hyperperfusion in the primary sensorimotor and anterior cingulate cortices. In particular, the DIPGI group had relative hypoperfusion in the lateral prefrontal, insular, inferior parietal, and cingulate cortices, which would be a pure DIP-related perfusion pattern. In the DIP group, parkinsonian motor severity was not correlated with striatal dopamine deficits but with the degree of relative brain perfusion in the prefrontal and cingulate cortices. On the contrary, that in the PD group was not correlated with brain perfusion but with striatal dopamine depletion, especially in the posterior putamen. The DIP-related brain perfusion pattern showed a good ability to discriminate patients with DIP from healthy controls or patients with PD.

Conclusion: Blockage of the dopamine receptor by drugs led to relative brain hypoperfusion, which was associated with symptom severity and can be utilized as a diagnostic biomarker.


Group comparison
*PD - HC
*DIP - HC
*DIP - PD
*DIP$_{GI}$ - HC
*DIP$_{AP}$ - HC
DIP$_{GI}$ - DIP$_{AP}$
Surface-based presentation
Volume-based presentation
-log$_{10}$P
5
1.3
1.3
3
-log$_{10}$P
5
1.3
1.3
5

LBA-5 Effect of High, Low, and Asymmetric Frequency Stimulation of the Subthalamic Nucleus in Parkinson's Disease: a Randomized Trial.

Z. Zeng, Z. Lin, P. Huang, Y. Pan, D. Li *(Shanghai, People's Republic of China)*

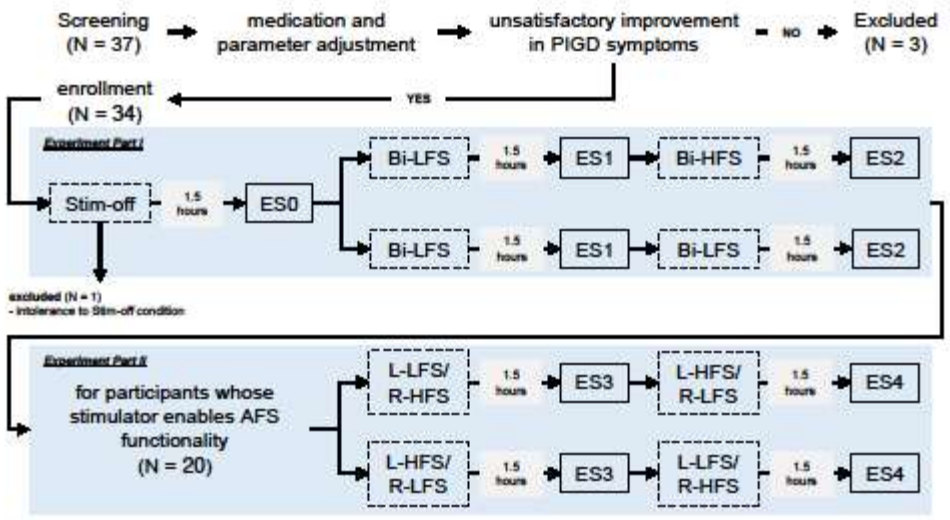
Objective: To verify the advantages of bilateral subthalamic nucleus (STN) low-frequency stimulation (Bi-LFS) over bilateral low-frequency stimulation (Bi-LFS) in improving axial symptoms and investigate the clinical efficacy of asymmetric frequency stimulation (AFS) in the treatment of Parkinson's disease (PD).

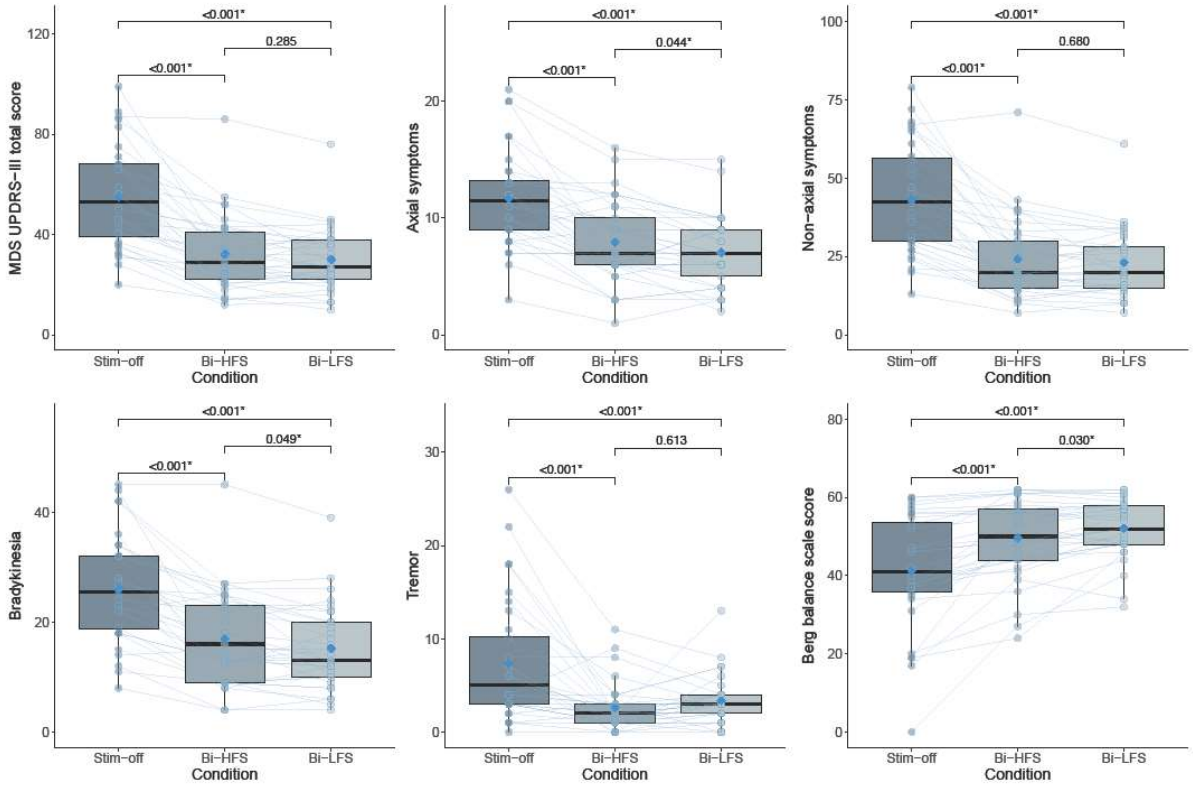
Background: Bilateral subthalamic nucleus (STN) high-frequency stimulation (Bi-HFS) may not effectively manage axial symptoms such as postural instability and gait disturbances. Bilateral low-frequency stimulation (Bi-LFS) and unilateral amplitude reduction have emerged as potential alternatives, yet their efficacy may be hindered by the re-emergence of limb symptoms. It remains unknown whether asymmetric frequency stimulation (AFS), combining unilateral low-frequency and contralateral high-frequency stimulation, can offer a novel approach to addressing axial symptoms while preserving overall motor symptom improvement.

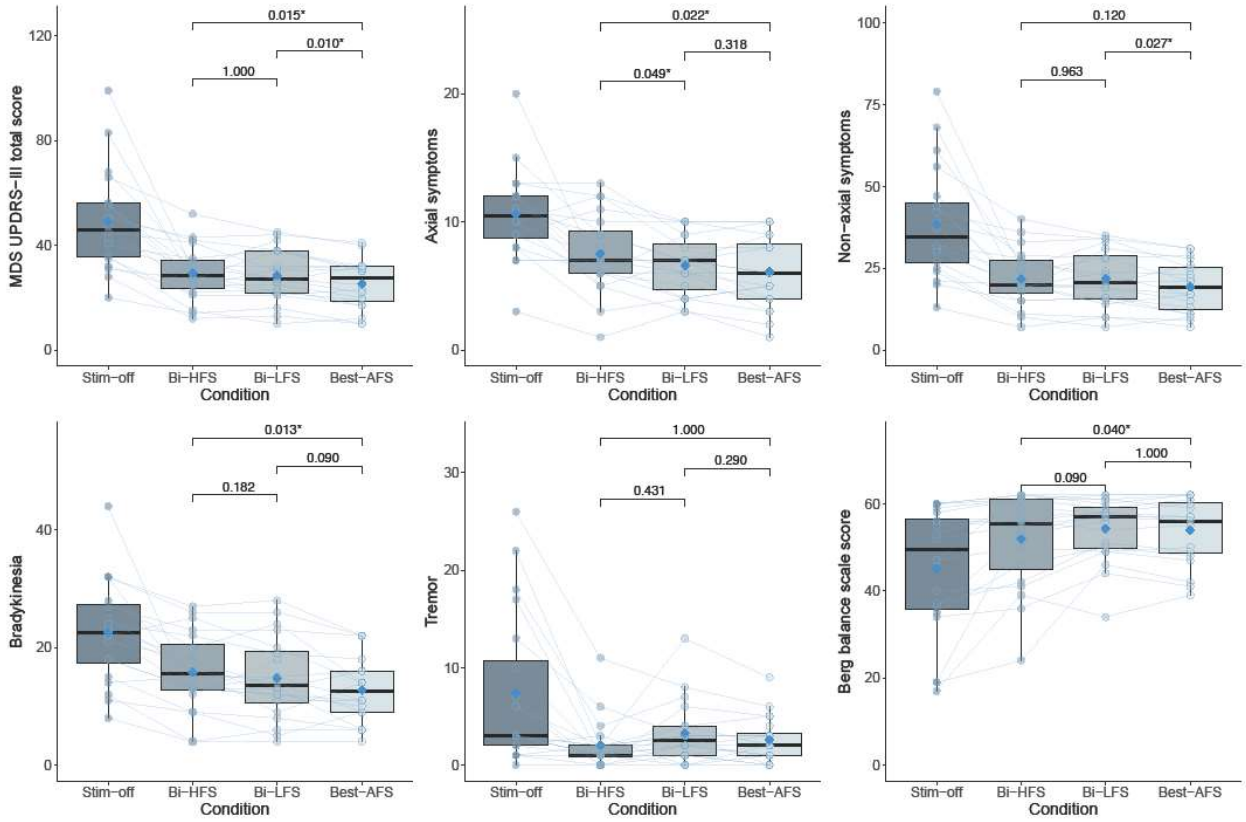
Method: In a randomized controlled design, we compared the efficacy of Bi-LFS and Bi-HFS (n = 33) and explored the efficacy of AFS (n = 20) in the acute setting in one cohort of postural instability gait difficulty (PIGD) motor subtype of patients with PD (Figure 1). Motor evaluations included MDS UPDRS-III, Berg balance scale (BBS), and gait kinematic analysis, and 6 to 12 months of telephone follow-up.

Results: Bi-LFS was superior to Bi-HFS in improving axial ($p = 0.044$) and bradykinesia ($p = 0.049$) sub-score of the MDS UPDRS-III and BBS ($p = 0.030$). AFS significantly reduced the total score of the MDS-UPDRS-III compared to Bi-HFS ($p = 0.015$) and Bi-LFS ($p = 0.010$) (Figure 2). AFS was comparable to Bi-LFS in axial, bradykinesia and balance symptoms but outperformed Bi-HFS ($p = 0.022$, 0.013, 0.040), while AFS was comparable to Bi-HFS but superior to Bi-LFS ($p = 0.027$) regarding the non-axial symptoms (Figure 3). Seventeen out of 20 participants (85.0%) who received AFS in the randomized phase favored AFS stimulation for the subsequently open-label phase, while half of those not tested with AFS switched back to Bi-HFS (46.2%). The selection of Best-AFS was significantly correlated with tremor severity in the Stim-off condition, showing a preference for high-frequency stimulation on the contralateral side ($r^2 = 0.37$, $p = 0.005$).

Conclusion: AFS may offer benefits for both axial and appendicular symptoms of PD and could be an alternative programming strategy in the management of parkinsonian axial symptoms refractory to conventional high-frequency STN DBS.


Screening
(N = 37)
medication and
parameter adjustment
unsatisfactory improvement
in PIGD symptoms
NO
Excluded
(N = 3)
YES
enrollment
(N = 34)
Experiment Part I
Stim-off
1.5 hours
ES0
Bi-LFS
ES1
Bi-HFS
ES2
excluded (N = 1)
- intolerance to Stim-off condition
Experiment Part II
for participants whose
stimulator enables AFS
functionality
(N = 20)
L-LFS/
R-HFS
ES3
L-HFS/
R-LFS
ES4


MDS UPDRS–III total score
Axial symptoms
Non–axial symptoms
Bradykinesia
Tremor
Berg balance scale score
<0.001*
0.285
0.044*
0.680
0.049*
0.613
0.030*
Stim–off
Bi–HFS
Bi–LFS
Condition



LBA-6 Prediction of disease outcomes in Parkinson's disease using biomarkers

DM. Au, HY. Wong, LKW. Cheng, YL. Cheng, HF. Or, KY. Mok, FCF. Ip, KW. See, GHF. Chan, TL. Poon, YF. Cheung, AK. Fu, NY. Ip *(Hong Kong, Hong Kong)*

Objective: This study characterizes the clinical and biomarker profiles of Parkinson's disease (PD) patients with regards to diagnosis, disease progression, and deep brain stimulation (DBS).

Background: PD is the second most common neurodegenerative disease worldwide. Biomarkers have become increasingly relevant in PD, especially in the contexts of early diagnosis, monitoring disease outcomes, predicting prognosis, and stratifying appropriate candidates for treatments.

Method: We conducted a cross-sectional study of PD patients from Queen Elizabeth Hospital in Hong Kong from 2020 to 2024. Motor and non-motor symptoms, quality of life (QoL), and plasma biomarker levels were studied.

Results: 132 PD patients were recruited, with an average age of 66.5 years and average disease duration of 9.1 years. Average H&Y stage was 2.4, S&E ADL score was 85.5%, and MDS-UPDRS part III score was 35.1. Average MoCA score was 26, with 15 patients scoring ≤21. Of the 16 patients who underwent DBS, 6 received treatment before recruitment (post-DBS, targeting bilateral subthalamic nuclei) and 10 after recruitment (pre-DBS).

When compared to healthy controls (HC) or Alzheimer's disease (AD) patients (adjusting for age and sex), the blood biomarkers NfL, GFAP, pTau217, and Aβ42/40 ratio were significantly different between PD and AD. Among cognitively impaired individuals (with MoCA ≤21), GFAP, pTau217, and Aβ42/40 ratio differed between PD and AD. NfL, which indicates neurodegeneration, was significantly different between PD and HC. Among PD patients, higher NfL levels were associated with worse H&Y stage, lower level of functioning, more severe motor symptoms, and worse cognition.

Compared to non-DBS candidates, pre-DBS patients had worse H&Y, MDS-UPDRS, S&E ADL, and PDQ-39 scores; higher levodopa equivalent daily dosage (LEDD); and longer disease duration. Post-DBS, S&E ADL, MDS-UPDRS, PDQ-39, NMSS, PDSS-2, and MoCA improved; LEDD reduced to a level comparable to that of non-DBS candidates.

Conclusion: This study suggests that NfL may reflect disease severity in PD, and that GFAP, pTau217, and Aβ42/40 ratio may be able to differentiate between cognitively impaired PD patients and AD patients. This study also shows that DBS candidates have more severe disease condition than non-DBS candidates. However, follow-up study with larger populations of cognitively impaired PD patients and DBS patients is needed to validate these trends.

LBA-7 A Phae 2a Multi-center, Randomized, Double-blind, Placebo-controlled, Parallel design, Trial to evaluate the efficacy and safety of GV1001 in Patients with Progressive Supranuclear Palsy

JY. Lee, HJ. Kim, TB. Ahn, JM. Kim, JW. Cho, D. Yoo, JH. Shin, R. Kim, B. Jeon *(Seoul, Korea)*

Objective: To explore the feasibility of GV1001 0.56 mg/day or 1.12 mg/day subcutaneous injection in patients with progressive supranuclear palsy (PSP) as a disease modifying agent.

Background: GV1001 is a synthetic peptide consisting of 16 amino acids corresponding to the sequence from 611 to 626 position of human telomerase reverse transcriptase (hTERT). This peptide has shown to improve memory and cognitive deficits in the 3xTg mouse model with reducing phosphorylated tau levels and promoting neuroprotective microglial and astrocytic phenotypes.1 In a 4R-tau mouse (TauP301L-BiFC), locomotor deficit was found to be improved with reducing tau accumulation in the brain.

Method: This is a 24-week, multicenter, randomized, double-blind, placebo-controlled, parallel design, Phase 2a clinical trial (NCT05819658). Inclusion criteria were probable PSP (PSP-RS and PSP-p) according to the MDS PSP diagnostic criteria with MMSE ≥15 and being able to walk ≥3 meters. Exclusion criteria were any structural lesion or concurrent neurological disorders besides PSP. Patients were randomized at a 1:1:1 ratio to GV1001 0.56 mg/day, 1.12 mg/day, or placebo. Investigational drugs were subcutaneously administered biweekly for 20 weeks following 4-weeks' weekly injection. Primary outcome is the change from baseline in total PSP-Rating Scale (PSP-RS) score after 24 weeks. Key secondary outcomes are the changes from baseline in PSPRS total score, MoCA-K, K-Frontal Assessment Battery, England & Schwab ADL after 12 and 24 weeks. Safety endpoints are any adverse event, laboratory tests, vital signs, and electrocardiogram. The efficacy analysis will be performed according to the "intention-to-treat principle," and the safety analysis as actually administered.

Results: Finally 78 patients were randomized to placebo (n=25), 0.56 mg (n=25) and 1.12 mg (n=28) groups, and 11 patients were dropped out (4 withdrew consent, 3 adverse events, 3 others). Baseline characteristics were not significantly different although the 1.12mg group tended to be older and males while the placebo group tended to have short disease duration and lower PSP-RS scores than the others. The primary endpoint was not met as the three-group difference was not statistically significant, but in a subgroup of PSP-Richarson (PSP-R) type, the 0.56mg group showed significantly less progression compared with the placebo group. The subgroup on 0.56mg also showed some improving tendency on MoCA scores. The proportion of responder rate in PSP-R patients were 58%, 37% and 25% in 0.56, 1.12 and placebo groups. Twelve serious adverse events were reported during trial with fractures (n=3) as most common followed by aspiration pneumonia (n=2).

Conclusion: This exploratory first-patient clinical trial in PSP, the GV1001 0.56 mg showed a clinically relevant benefit in PSP-RS type patients in a relatively short period (24 weeks) of treatment. The 67 patients who completed the 24 week's treatment entered the 52 weeks' open-label GV1001 1.12mg/day biweekly extension trial (NCT06235775). The on-going 12 months extension trial could show long-term safety of GV1001 and potential long-term therapeutic effects in PSP patients.

LBA-8 The effect and limits of unilateral magnetic resonance-guided focused ultrasound pallidotomy for Parkinson's disease

Y. Osakada, H. Hirabayashi, T. Yamashita, H. Ohnishi, H. Ohnishi, H. Ishiura *(Okayama, Japan)*

Objective: The purpose of this study was to investigate the effectiveness and limitations of unilateral MR-guided focused ultrasound (MRgFUS) pallidotomy in the treatment of Parkinson's disease (PD).

Background: Recently, MRgFUS has emerged as a noninvasive treatment for various neurological disorders, including essential tremor, tremor-dominant PD, and some psychiatric conditions. In Japan, the number of unilateral MRgFUS Vim thalamotomies is increasing. However, unilateral pallidotomy for the motor symptoms of PD has not yet been widely adopted.

Method: Between March 2021 and July 2023, nine PD patients with L-dopa responsiveness, motor fluctuations, and dyskinesias who underwent unilateral pallidotomy using MRgFUS were included in this study. MRgFUS pallidotomy was performed using the InSightec ExAblate 4000 Transcranial System in conjunction with a 3T GE Medical System MRI machine.

Results: The mean age of the patients was 72.0 years (range 58–77 years). The mean time since diagnosis was 13.7 years, and the mean daily L-dopa equivalent dose was 1032 ± 324 mg. Eight of the nine treated patients completed the 12-month follow-up visit. The sonication procedure was successfully completed in eight patients. In one patient, sufficient temperature elevation could not be achieved due to cavitation (patient 7). The severity of dyskinesia, as measured by the Unified Dyskinesia Rating Scale (UDysRS), was significantly improved up to 12 months (baseline mean score 42.4, 95% CI 18.0; at 12 months 20.0, 95% CI 9.8, 52.8% improvement, p = 0.03). Temporal significant improvements were observed in the Unified Parkinson's Disease Rating Scale (UPDRS) parts 1 and 3 in the "off" medication state (Part 1: baseline mean score 19.8, 95% CI 5.3; at 6 months 15.2, 95% CI 9.0, p = 0.047; Part 3 "off": baseline mean score 43.6, 95% CI 13.8; at 3 months 33.8, 95% CI 17.8, 22.5% improvement,

p = 0.023). The scores, however, returned to baseline by 12 months. No significant improvement was observed in UPDRS parts 2 and 3 in the "on" medication state, and no reduction in medication was achieved. Adverse neurological events were generally mild and transient, including impulse control disorder (patient 1) and visual field deficit (patient 2).

Conclusion: Unilateral pallidotomy for Parkinson's disease provides sustained improvement in dyskinesia even after one year; however, the improvement in motor fluctuations lasts only for a limited period post-surgery. This study included many elderly patients who were not candidates for DBS, but the procedure was safely performed with only minor complications. (2300 characters)

LBA-9 Noninvasive Temporal Interference Subthalamic Stimulation for Treating Motor Symptoms in Parkinson's Disease

CH. Yang, YX. Xu, U. Ziemann, CC. Zhang, Y. Liu *(Shanghai, People's Republic of China)*

Objective: To assess the efficacy of individually tailored subthalamic nucleus (STN)Transcranial temporal interference stimulation (tTIS) protocols in alleviating motor impairments in Parkinson's disease (PD).

Background: tTIS offers an innovative approach to deep brain stimulation, presenting the promising clinical potential for managing motor symptoms in PD.

Method: This single-center, double-blind, placebo-controlled, randomized crossover trial enrolled individuals with idiopathic PD (Hoehn and Yahr stages 1.5–3) from hospitals and communities in Shanghai. A total of 30 participants were included, with a mean age of 69.5 years, an average disease duration of 9.37 years, and a mean Hoehn and Yahr stage of 2.23. Participants completed a 20-minute session of individually optimized contralateral STN tTIS in the "off-medication" state. The placebo condition utilized active sham stimulation, replicating the electrode placement and intensity of tTIS but without generating an interference electric field. Motor symptoms were evaluated using the Movement Disorder Society Unified Parkinson's Disease Rating Scale Part III (MDS-UPDRS-III). The primary outcome was the total motor score, while secondary outcomes included subscale scores for the four cardinal symptoms of PD: bradykinesia, rigidity, tremor, and axial signs. Outcomes were assessed at baseline, immediately post-stimulation, and 30- and 60-minutes post-stimulation. Side effects were monitored throughout.

Results: The primary outcome measure, the MDS-UPDRS-III total score, showed an immediate mean improvement of 6.37 points post-stimulation, peaking at 7.97 points (19.8%) at 30 minutes, and sustaining an improvement of 7.33 points at 60 minutes. The placebo stimulation showed no significant changes. Among secondary outcomes, bradykinesia and tremor improved by 3.53 points (19.6%) and 2.8 points (30.1%), respectively, at 30 minutes post-stimulation, while rigidity and axial signs were not statistically significant. No participants discontinued the intervention. Side effects were mild, primarily itching and tingling, with no severe reactions reported.

Conclusion: Individually tailored STN tTIS protocols demonstrated significant efficacy in reducing motor symptoms in PD, with minimal side effects. These findings provide strong clinical evidence for the therapeutic potential of tTIS in PD management.

Figure 1. CONSORT Flow Diagram

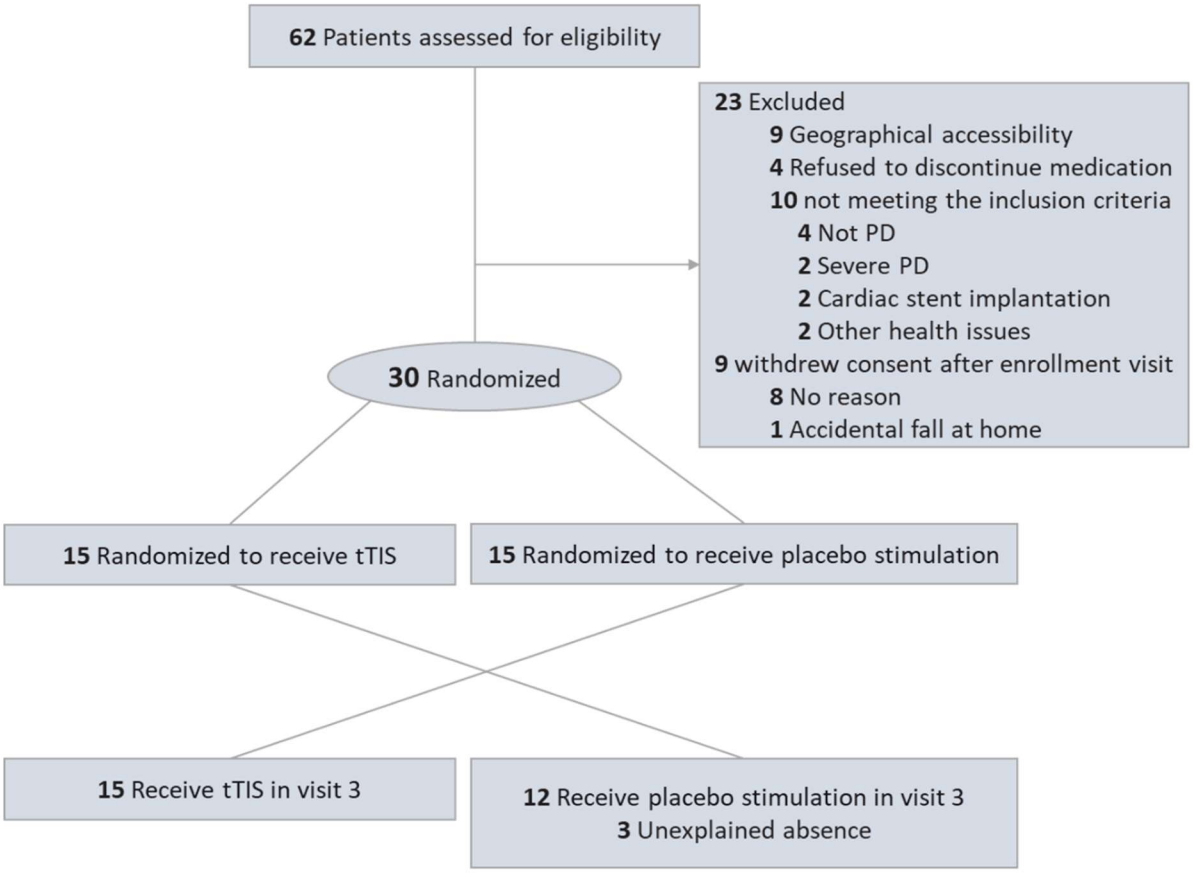


Table 1. Baseline Demographics and Clinical Characteristics

Characteristics	Participants (n = 30)
Age, mean (SD), y	69.5 (6.6)
Female, No. (%)	19 (63.3)
Parkinson's Disease duration, mean (SD), y	9.4 (4.4)
Right dominant side, No. (%)	28 (93.3)
Severe side, No. (%)	
Right	7 (23.3)
Left	9 (30.0)
Bilateral	14 (46.7)
LEDD, mean (SD), mg	727.4 (287.2)
MDS-UPDRS-III score, mean (SD)	38.7 (10.7)
Hoehn and Yahr stage, No. (%)	
1.5 - 2	17 (56.7)
2.5 - 3	13 (43.3)
MoCA score, mean (SD)	26.2 (2.5)

LEED: levodopa equivalent daily dose; MDS-UPDRS-III: Part III of the Movement Disorder Society-Sponsored Revision of the Unified Parkinson's Disease Rating Scale; MoCA: Montreal Cognitive Assessment.

Table 2. Outcomes measures before and after transcranial temporal interference stimulation.

Outcomes	sham	tTIS	Within-Group Difference in Mean Change from Pre-Stimulation			
	(n =27) Mean (SD)	(n = 30) Mean (SD)	Sham Mean (95% CI)	*P*-value	tTIS Mean (95% CI)	*P*-value
MDS-UPDRS-III						
Pre	38.08 (11.84)	40.23 (11.18)				
Post	35.92 (11.74)	33.87 (10.96)	2.15 (0.05 to 4.2)	**0.04**	6.37 (4.00 to 8.73)	**< 0.001**
30min-post	36.97 (11.55)	32.27 (11.75)	1.11 (-1.13 to 3.35)	0.54	7.97 (5.76 to 10.17)	**< 0.001**
60min-post	35.80 (10.37)	32.90 (11.70)	2.28 (-0.63 to 5.17)	0.17	7.33 (4.96 to 9.70)	**< 0.001**
Rigidity						
Pre	6.33 (3.51)	6.33 (3.80)				
Post	5.92 (3.74)	6.17 (3.63)	0.41 (-0.22 to 1.04)	0.31	0.17 (-0.72 to 1.05)	0.96
30min-post	6.33 (3.40)	5.57 (3.75)	0.00 (-0.80 to 0.81)	>0.99	0.77 (-0.21 to 1.75)	0.17
60min-post	6.28 (2.95)	5.30 (3.63)	0.05 (-0.90 to 0.10)	>0.99	1.03 (0.29 to 1.78)	0.004
Bradykinesia						
Pre	16.97 (4.84)	17.93 (4.96)				
Post	15.97 (4.84)	14.87 (4.35)	1.00 (-0.24 to 2.24)	0.18	3.07 (1.27 to 4.87)	**<0.001**
30min-post	16.97 (4.61)	14.40 (4.64)	0.00 (-1.36 to 1.36)	>0.99	3.53 (1.46 to 5.60)	**<0.001**
60min-post	16.72 (3.99)	14.97 (4.92)	0.25 (-1.53 to 2.03)	>0.99	2.97 (1.32 to 4.62)	**<0.001**
Axial						
Pre	7.00 (2.67)	6.63 (2.85)				
Post	6.59 (2.93)	5.70 (2.74)	0.41 (0.05 to 0.76)	0.02	0.93 (0.36 to 1.50)	<0.001
30min-post	6.67 (2.97)	5.77 (2.46)	0.33 (-0.12 to 0.78)	0.22	0.87 (0.13 to 1.60)	0.02
60min-post	6.37 (2.80)	5.70 (2.51)	0.63 (-0.07 to 1.34)	0.09	0.93 (0.14 to 1.73)	0.02
Tremor						
Pre	7.78 (6.66)	9.33 (7.01)				
Post	7.44 (6.61)	7.13 (6.27)	0.34 (-0.79 to 1.47)	>0.99	2.20 (0.91 to 3.49)	**<0.001**
30min-post	6.81 (6.38)	6.53 (6.02)	0.97 (-0.09 to 2.01)	0.08	2.80 (1.47 to 4.13)	**<0.001**
60min-post	6.43 (5.77)	6.93 (6.16)	1.35 (0.12 to 2.57)	**0.03**	2.40 (1.12 to 3.68)	**<0.001**

MDS-UPDRS-III: Part III of the Movement Disorder Society-Sponsored Revision of the Unified Parkinson's Disease Rating Scale; MDS-UPDRS-III sub-scores: (l) rigidity (item 3.3); (2) bradykinesia (items 3.2, 3.4, 3.8, 3.14), (3) tremor (items 3.15-3.18), and (4) axial signs (items 3.9-3.13).

LBA-10 The Regional Burden of Parkinson's Disease in Kazakhstan 2014–2021: Insights From National Health Data

R. Akhmedullin, A. Gusmanov, G. Zhakhina, B. Crape, T. Aimyshev, Y. Semenova, G. Kyrgyzbay, A. Gaipov
(Astana, Kazakhstan)

Objective: To provide epidemiology of Parkinson's disease in Central Asia

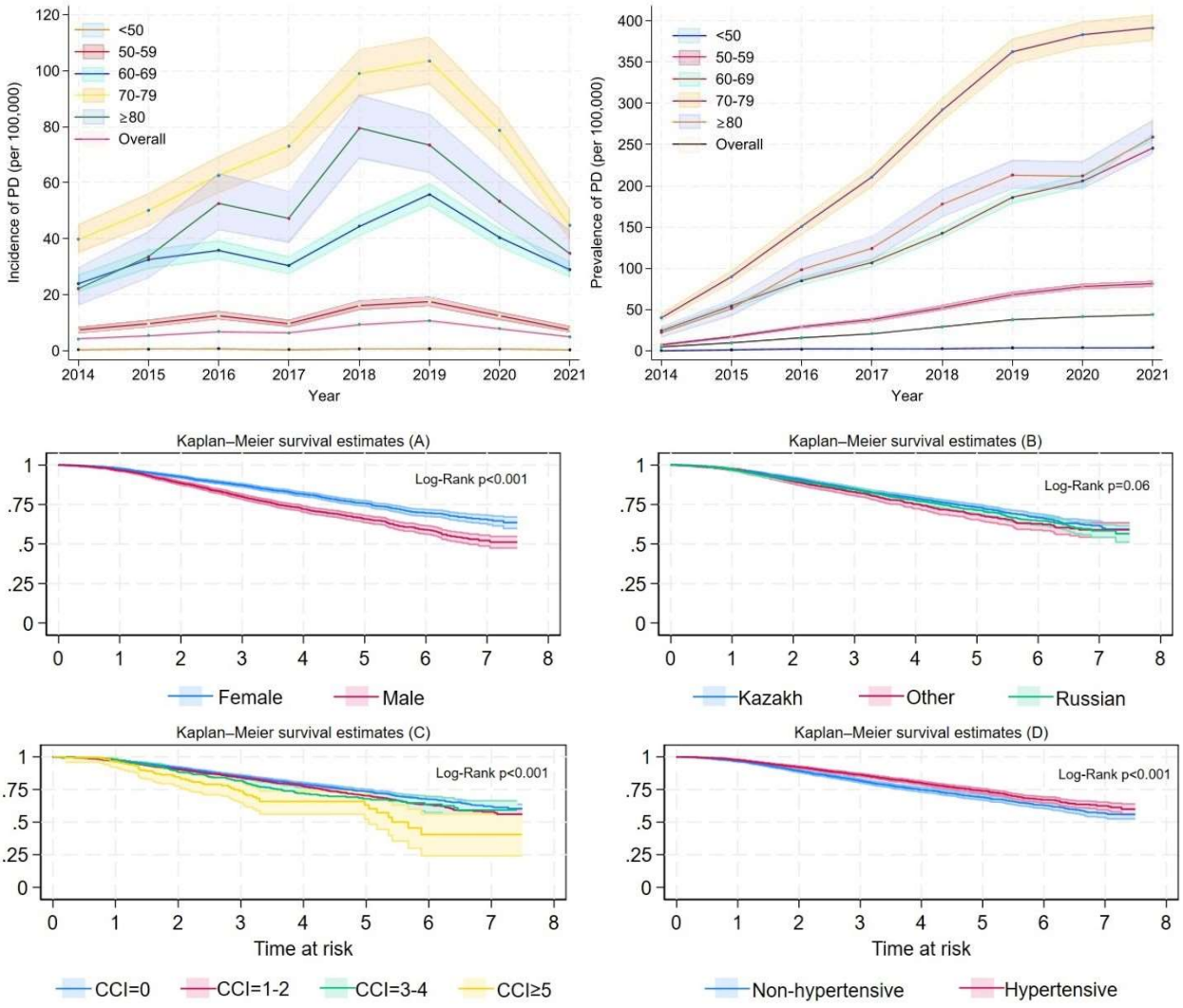
Background: This study explores the burden of Parkinson's disease (PD) in Kazakhstan, the largest country in Central Asia, a region where data on neurological disorders is notably sparse.

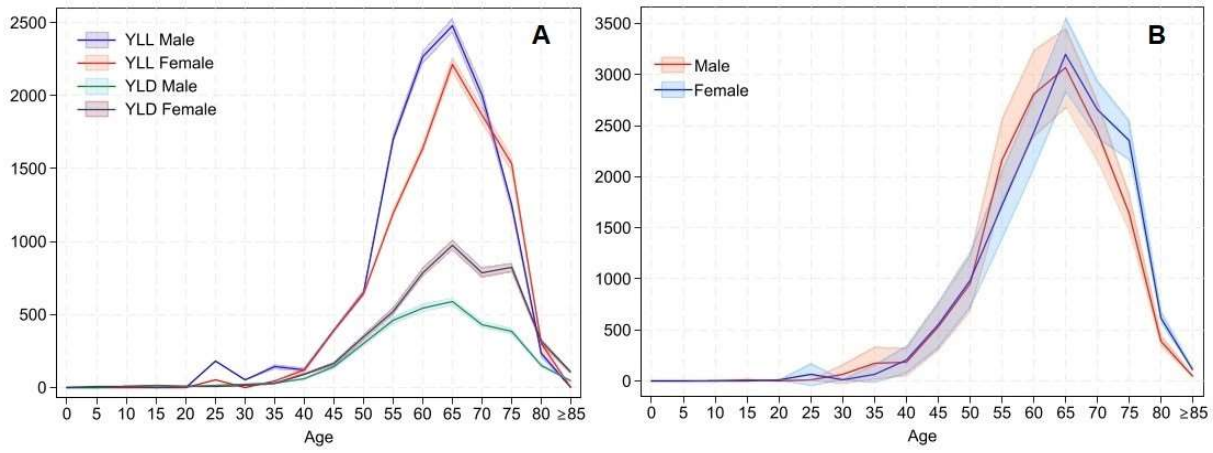
Method: Utilizing data from Kazakhstan's Unified National Electronic Health System during 2014-2021, the study investigates the epidemiology, Disability-Adjusted Life Years (DALYs), and survival outcomes in a cohort of PD patients. The authors employed Cox proportional hazards regression models and Kaplan-Meier analysis, alongside sensitivity analyses, to assess the impact of demographic factors, hypertension, and the Charlson Comorbidity Index (CCI) on survival.

Results: The study cohort included 10,125 patients, revealing a tenfold increase in PD prevalence during the study period. Mortality rates varied significantly, with the highest rates observed in the eldest age group (137.05 per 1000 person-years). PD contributed to a loss of 156.12 DALYs per 100,000 population, primarily driven by years of life lost. The analysis identified an increased risk of all-cause mortality among males (adjusted hazard ratio [aHR] 1.6; 1.5-1.8), older individuals (aHR 1.05; 1.04-1.06), those

with higher CCIs, and individuals of Kazakh ethnicity. Interestingly, patients with comorbid hypertension had a higher probability of survival (aHR 0.67; 0.60-0.73).

Conclusion: This study is the first of its kind in Central Asia to examine the burden of PD using a large-scale outpatient registry. The findings underscore the need for targeted interventions to address the growing burden of PD, particularly among males and ethnic Kazakhs. Additionally, further research is needed to explore the inverse association between hypertension and survival in the PD cohort.





LBA-11 Antiepileptic Drugs and Parkinson's Disease: A Meta-Analysis of Existing Evidence

R. Akhmedullin, D. Kalinina, A. Sarria-Santamera, D. Almabayeva, R. Kaiyrzhanov *(Astana, Kazakhstan)*

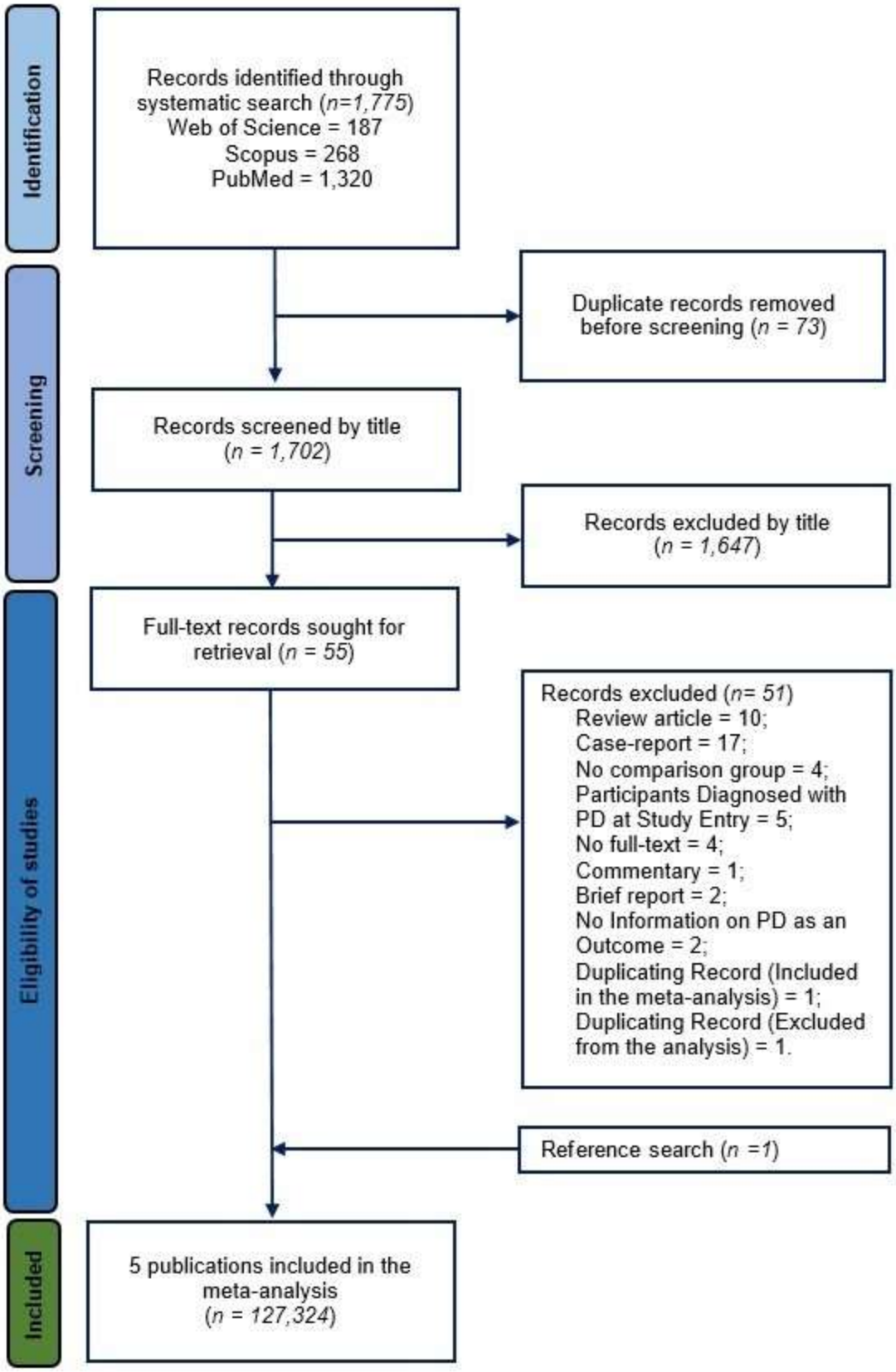
Objective: The aim of this study is to conduct a meta-analysis to provide a critical summary of the association between AEDs and PD.

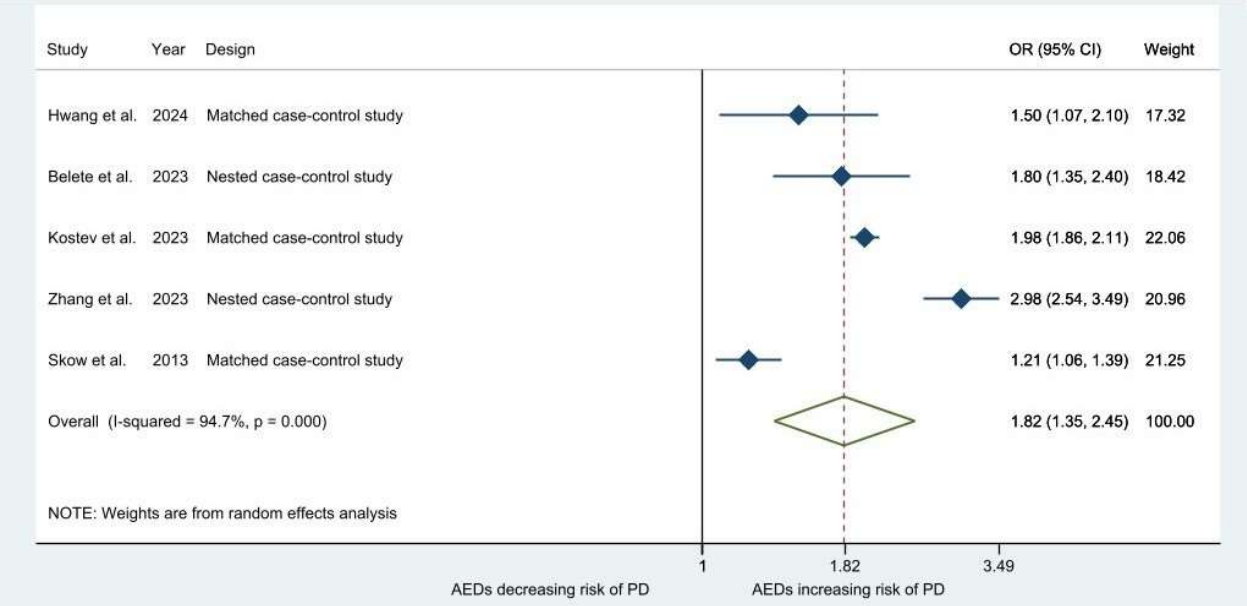
Background: There is growing interest in the association between antiepileptic drugs (AEDs) exposure and subsequent Parkinson's disease (PD). Recognizing this, this study aims to perform a meta-analysis to critically evaluate the link between AEDs and PD.

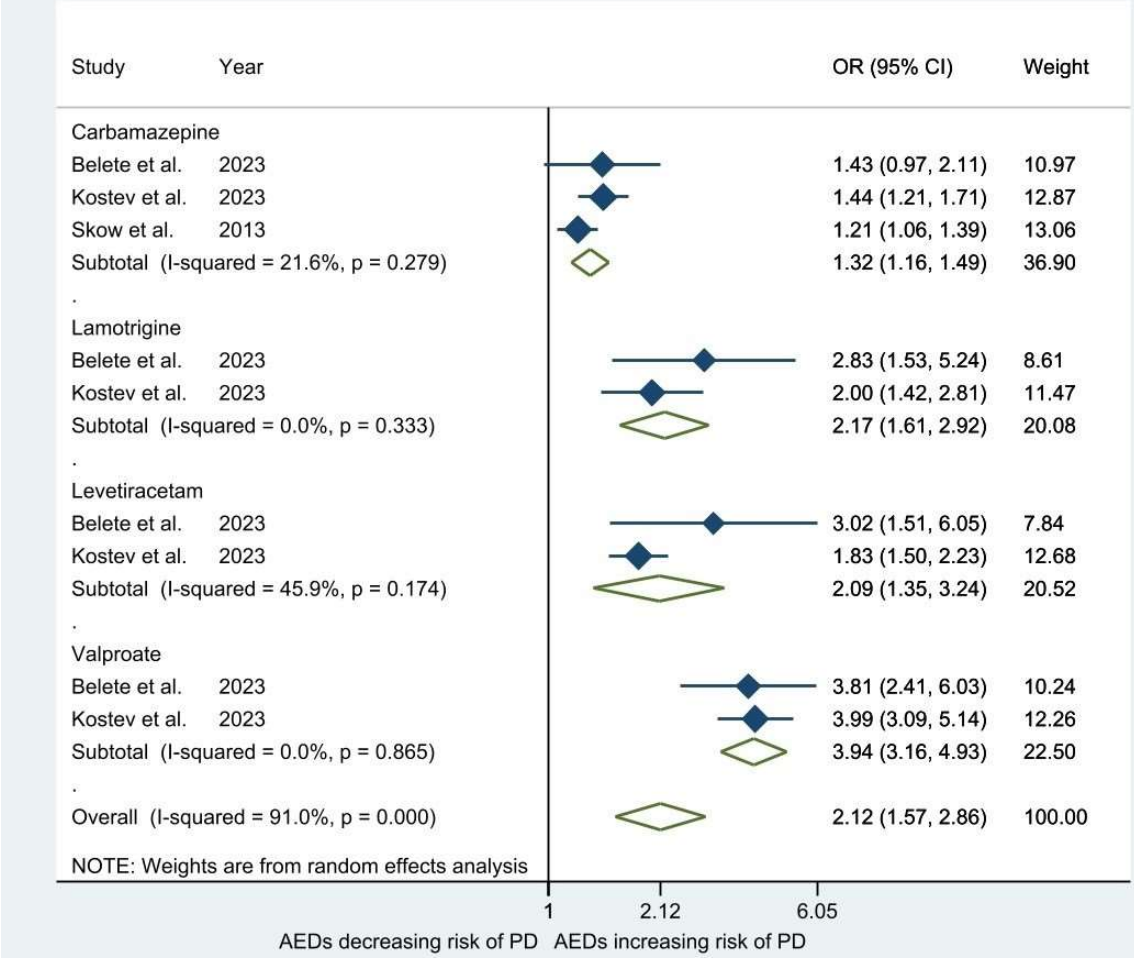
Method: We conducted a literature search of PubMed, SCOPUS, and Web of Science databases up to October 2024. We identified studies using an observational design, and performed a meta-analysis to evaluate the association between AEDs exposure and incident PD. We assessed the quality of the studies and identified the pooled odds ratio (OR) for those exposed to AEDs compared with those who were not. Heterogeneity was investigated using the I^2 statistic and significance was determined using Cochran's Q-test. An additional Bayesian analysis was used to test the accuracy of the estimations, and a post-hoc Egger's regression test was performed to evaluate the small study bias. This study was registered in PROSPERO.

Results: Of the 1775 unique studies identified, 55 were selected for full-text review. Five studies (N = 127,324) were eligible for inclusion. Quality assessment revealed moderate-to-high methodological quality in the included studies. The overall OR for incident PD was 1.82 times (95% CI: 1.35-2.45) higher for AEDs recipients. When considering each drug individually, the association was highest for valproate (OR 3.94 (95% CI: 3.15-4.92) and lowest for carbamazepine (OR 1.32 (95% CI: 1.16-1.49). Further, Bayesian analysis revealed overlapping estimates.

Conclusion: Despite the significant associations observed, the existing evidence is still insufficient, making it premature to draw inferences about the association between AEDs and PD. Further well-designed studies are required to explore this relationship. Any observed associations should be interpreted with caution.


Identification
Records identified through systematic search (n=1,775)
Web of Science = 187
Scopus = 268
PubMed = 1,320
Screening
Duplicate records removed before screening (n = 73)
Records screened by title (n = 1,702)
Records excluded by title (n = 1,647)
Eligibility of studies
Full-text records sought for retrieval (n = 55)
Records excluded (n= 51)
Review article = 10;
Case-report = 17;
No comparison group = 4;
Participants Diagnosed with PD at Study Entry = 5;
No full-text = 4;
Commentary = 1;
Brief report = 2;
No Information on PD as an Outcome = 2;
Duplicating Record (Included in the meta-analysis) = 1;
Duplicating Record (Excluded from the analysis) = 1.
Reference search (n =1)
Included
5 publications included in the meta-analysis (n = 127,324)


Study Year Design OR (95% CI) Weight
Hwang et al. 2024 Matched case-control study 1.50 (1.07, 2.10) 17.32
Belete et al. 2023 Nested case-control study 1.80 (1.35, 2.40) 18.42
Kostev et al. 2023 Matched case-control study 1.98 (1.86, 2.11) 22.06
Zhang et al. 2023 Nested case-control study 2.98 (2.54, 3.49) 20.96
Skow et al. 2013 Matched case-control study 1.21 (1.06, 1.39) 21.25
Overall (I-squared = 94.7%, p = 0.000) 1.82 (1.35, 2.45) 100.00
NOTE: Weights are from random effects analysis
1
1.82
3.49
AEDs decreasing risk of PD
AEDs increasing risk of PD


Study Year OR (95% CI) Weight
Carbamazepine
Belete et al. 2023 1.43 (0.97, 2.11) 10.97
Kostev et al. 2023 1.44 (1.21, 1.71) 12.87
Skow et al. 2013 1.21 (1.06, 1.39) 13.06
Subtotal (I-squared = 21.6%, p = 0.279) 1.32 (1.16, 1.49) 36.90
Lamotrigine
Belete et al. 2023 2.83 (1.53, 5.24) 8.61
Kostev et al. 2023 2.00 (1.42, 2.81) 11.47
Subtotal (I-squared = 0.0%, p = 0.333) 2.17 (1.61, 2.92) 20.08
Levetiracetam
Belete et al. 2023 3.02 (1.51, 6.05) 7.84
Kostev et al. 2023 1.83 (1.50, 2.23) 12.68
Subtotal (I-squared = 45.9%, p = 0.174) 2.09 (1.35, 3.24) 20.52
Valproate
Belete et al. 2023 3.81 (2.41, 6.03) 10.24
Kostev et al. 2023 3.99 (3.09, 5.14) 12.26
Subtotal (I-squared = 0.0%, p = 0.865) 3.94 (3.16, 4.93) 22.50
Overall (I-squared = 91.0%, p = 0.000) 2.12 (1.57, 2.86) 100.00
NOTE: Weights are from random effects analysis
1
2.12
6.05
AEDs decreasing risk of PD
AEDs increasing risk of PD

LBA-12 Deep brain stimulation of the posterior subthalamic area and the subthalamic nucleus in tremor-dominant Parkinson's disease: a randomized, crossover trial

ZY. Lin, ZT. Zeng, YX. Pan, P. Huang, YY. Tan, DY. Li *(Shanghai, People's Republic of China)*

Objective: To evaluate deep brain stimulation (DBS) of the posterior subthalamic area (PSA) in tremor-dominant Parkinson's disease (TD-PD) and compare it to the subthalamic nucleus (STN) in terms of efficacy and side effects.

Background: The STN is a well-established DBS target in TD-PD. The PSA has been suggested as an alternative target while the evidence remains limited. A direct comparison of the stimulation efficacy and side effects of PSA- versus STN-DBS in TD-PD is lacking.

Method: Participants underwent bilateral single-trajectory PSA-STN dual target DBS surgery. Those with at least one contact in the PSA and STN, respectively, were included in the subsequent crossover phase (Figure 1A, Figure 2). The primary endpoint was the difference in tremor sub-score of the MDS UPDRS-III between 2-month PSA- versus STN-DBS. Linear mixed model was used for repeated measurements to account for the crossover design (NCT05382858).

Results: Beginning in June 2022, forty patients were screened for inclusion, twenty-seven of whom were entered into the crossover phase (Figure 1B). Up to the time of submission, sixteen participants (ten males) completed the crossover phase and outcomes were reported here. The mean age at enrollment was 60.6 (SD 7.2) years old. The mean disease duration was 10.4 (SD 4.9) years. No intracranial hemorrhage or infection was observed. Abnormally high impedance was documented in three participants in the open-label phase, two of whom received IPG replacement. Eight patients (6 STN-DBS and 2 PSA-DBS) did not tolerate chronic respective stimulation condition due to intolerable side effects or unsatisfactory symptom control. Acute motor evaluation was then completed. Outcome parameters were listed in Table 1. In the comparison of PSA- and STN-DBS, better postoperative tremor suppression in the tremor sub-score of the MDS UPDRS-III was observed under PSA stimulation ($p = 0.009$). The axial tremor, as measured by the FTM-TRS, was better reduced by PSA-DBS compared to STN-DBS ($p = 0.030$). In contrast, the balance control, as measured by Berg balance scale, was better improved under STN-DBS ($p = 0.001$). In the open-label phase, four (25%) of the sixteen randomized patients favored PSA-DBS and four (25%) favored STN-DBS. The other eight patients (50%) had active contacts in both PSA and STN.

Conclusion: This preliminary report indicated that for patients with TD-PD, PSA-DBS may offer comparable overall motor symptom control but better tremor control than STN-DBS.

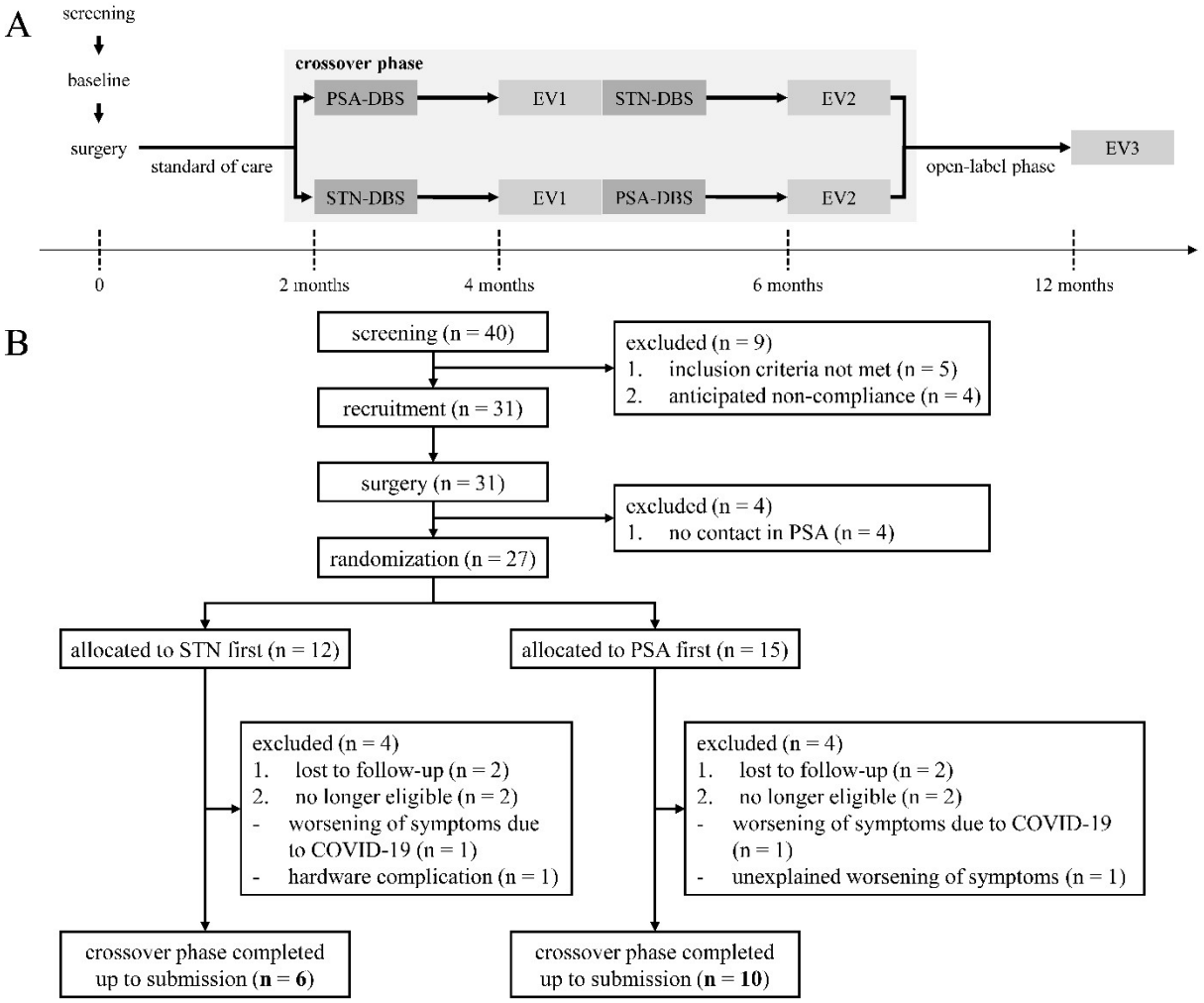


Figure 1. Study design (A) and profile (B). (A) During the first 2 months after the surgery, patients received the standard of care in our center. The crossover phase began at the 2-months follow-up and lasted 4 months. Participants were randomized into 2 crossover groups with either 2 months of PSA stimulation followed by 2 months of STN stimulation or vice versa. A programming visit were held at the beginning of each period, in which the optimal parameters, i.e., best patient-reported motor symptom control with no or tolerable side effects were determined. Additional programming visits could be requested by patients in each period if necessary. Monopolar, bipolar, or interleaving stimulation were allowed. Outcomes parameters were assessed in the evaluation visit (EV) at the end of each crossover phase. If insufficient motor symptom control, in most cases the tremor suppression, or intolerable side effects made switching contacts necessary, the corresponding crossover phase could not be continued for ethical reasons. Thus, the evaluation visit was performed ahead of the scheduled time point. During the crossover phase, participants and raters were blinded to the stimulation parameters. The crossover phase was followed by an open-label phase lasting 6 months. (B) Forty patients were screened, and thirty-one were recruited and underwent bilateral single-trajectory PSA-STN dual target DBS surgery. Four patients were excluded because there was no contact in PSA after verifying the fusion image of the postoperative CT and preoperative MRI. Subsequently, twenty-seven patients entered the crossover phase, twelve of whom were allocated to STN stimulation first and the other fifteen were allocated to PSA stimulation first. Four participants were further excluded from each group. Up to time of submission, sixteen participants completed the crossover phase.

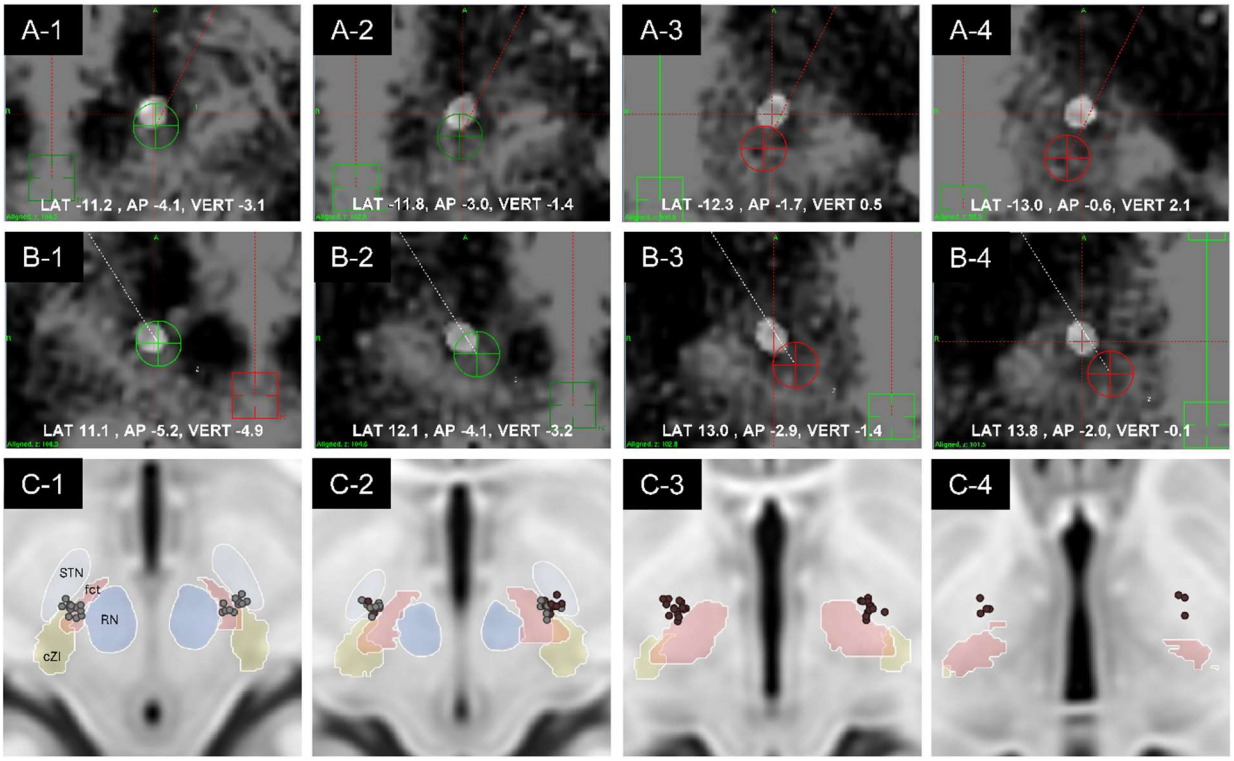


Figure 2. Contact locations. Both PSA and STN were directly targeted on high-resolution T2-weighted images. The trajectory was planned by using the PSA as the primary target. The coronal and sagittal angles were adjusted to obtain a trajectory traversing the STN target and to avoid sulci, blood vessels, and ventricles. The location of the ventro-most to dorso-most contacts of left [(A-1)-(A-4)] and right [(B-1)-(B-4)] lead were shown. (C-1)-(C-4) showed the active contact location of the PSA stimulation (grey circle) and STN stimulation (brown circle) condition. The AC-PC based coordinates with respect to the midcommissural point for PSA stimulation condition were as follows: lateral 11.0 (SD 2.3) mm, vertical -4.3 (SD 1.4) mm, axial -3.3 (SD 1.6) mm. The AC-PC based coordinates for STN stimulation condition were as follows: lateral 12.5 (SD 1.5) mm, vertical -2.5 (SD 1.4) mm, axial -0.9 (SD 1.5) mm.
Abbreviation: cZI, caudal zona incerta; fct, fasciculus cerebellothalamicus; RN, red nucleus; STN, subthalamic nucleus

Table 1. Outcome parameters.

	Baseline versus PSA/STN							PSA vs STN	
				Change from baseline to PSA		Change from baseline to STN		Comparison of PSA and STN	
Endpoint	**Baseline**	**PSA**	**STN**	**Difference**	***p*-value**	**Difference**	***p*-value**	**Difference**	***p*-value**
MDS UPDRS-III									
Total score	56.4 ± 11.4	30.9 ± 14.4	31.0 ± 14.1	-25.4	**<0.001***	-25.4	**<0.001***	-1.38	0.439
Tremor	17.8 ± 3.3	6.0 ± 4.1	6.9 ± 5.2	-11.8	**<0.001***	-10.9	**<0.001***	-3.37	**0.009***
Rigidity	10.3 ± 3.2	7.1 ± 3.5	7.4 ± 2.9	-3.2	**0.002***	-2.9	**0.006***	1.27	0.061
Bradykinesia	22.4 ± 7.2	13.2 ± 6.1	12.8 ± 5.0	-9.3	**<0.001***	-9.7	**<0.001***	0.48	0.594
Axial	5.8 ± 2.3	4.6 ± 4.2	4.0 ± 4.3	-1.2	0.146	-1.8	**0.046***	0.23	0.553
Gait	1.6 ± 0.7	1.4 ± 1.4	1.2 ± 1.2	-0.2	0.161	-0.4	0.067	0.20	0.271
FTM-TRS									
Part A + B	37.6 ± 19.8	10.9 ±8.3	13.8 ± 15.4	-26.7	**<0.001***	-23.8	**<0.001***	-6.22	0.054
Part C	10.5 ± 6.0	5.9 ± 4.5	4.4 ± 3.5	-5.4	**0.001***	-6.7	**0.008***	-2.78	**0.001***
Hand function	27.0 ± 14.4	8.7 ± 7.2	10.3 ± 12.7	-18.3	**<0.001***	-16.8	**<0.001***	-4.72	0.082
Axial tremor	6.7 ± 5.0	1.6 ± 1.6	2.2 ± 2.1	-5.1	**<0.001***	-4.5	**<0.001***	-1.17	**0.030***
BBS	48.6 ± 11.5	50.4 ± 6.1	50.5 ± 6.0	1.8	0.531	1.9	0.292	-1.97	**0.001***
LEDD	550.1 ± 243.3	264.3 ± 155.6	252.5 ± 223.5	-292.9	**0.002***	-292.9	**0.005***	68.47	0.202
MMSE	24.1 ± 3.1	24.3 ± 2.4	24.4 ± 2.7	0.5	0.403	0.3	0.669	-0.62	0.371
BDI	6.7 ± 4.9	2.8 ± 3.4	3.5 ± 5.0	-4.2	**0.012***	-4.8	**0.028***	0.08	0.952
BAI	10.6 ± 7.2	4.0 ± 4.4	6.0 ± 6.2	-6.9	**0.002***	-6.6	**0.018***	-1.69	0.211
MDS UPDRS-I	7.9 ± 4.6	4.3 ± 3.5	7.3 ± 6.5	-3.8	**0.007***	-2.8	0.160	0.06	0.970
MDS UPDRS-II	12.5 ± 6.8	9.9 ± 10.1	10.3 ± 14.1	-2.7	0.289	-4.5	0.182	-3.40	**0.041***
MDS UPDRS-IV	6.1 ± 3.1	2.8 ± 2.5	2.0 ± 2.8	-3.3	**0.008***	-4.4	**0.049***	-0.91	0.474
NMSS	28.0 ± 19.1	15.4 ± 12.3	22.7 ± 11.1	-15.0	**0.019***	-13.3	0.161	-1.05	0.745
PDQ-39 SI	15.9 ± 13.6	8.6 ± 6.3	7.3 ± 6.9	-9.0	**0.013***	-12.1	**0.011***	-2.01	0.249

Abbreviations: BAI, Beck Anxiety Inventory; Beck Depression Inventory; BBS, Berg Balance Scale; MDS UPDRS, FTM-TRS, Fahn-Tolosa-Marin Tremor Rating Scale; MDS-sponsored Unified Parkinson's Disease Rating Scale; LEDD, levodopa equivalent daily dose; MMSE, Mini-Mental State Examination; BDI, NMSS, Non-Motor Symptoms Scale for Parkinson's Disease; PDQ-39 SI, 39-item Parkinson's Disease Questionnaire Summary Index; PSA, posterior subthalamic area; STN, subthalamic nucleus

All outcome parameters are summarized as mean ± standard deviation (SD). Changes from baseline to PSA- or STN-DBS were analyzed by the pairwise Wilcoxon test. Differences may deviate from values displayed due to rounding and missing values. Differences in the comparison of PSA DBS and STN DBS differ from the values displayed for the comparisons with baseline due to the use of adjusted means in the linear mixed model for the crossover phase. Linear mixed model was used for repeated measurements to account for the crossover design. The Wilcoxon signed-rank test was used for the comparison between stimulation condition and preoperative baseline.

*Significant results.