

Table S1. Summary of all performed analyses among the various brain lesion and motor function measures.

Analysis	sqMRI scores	Function	Gait	Reported results
1. Spearman's rank correlations (r_s)	Continuous (Global total; adjusted global total; global total hemispheric; global total subcortical; laterality hemispheres)	Ordinal (GMFCS)	Continuous (GPSs and GVSs)	Correlation coefficients and p-values
	Ordinal (Total corpus callosum; total cerebellum; lobes: frontal, parietal, temporal, occipital; layers: PV, M, CSC)			
2. Point-biserial correlations^a (r_{pb})	Dichotomous (Subcortical structures: lenticular nucleus, caudate nucleus, PLIC, thalamus, brainstem; Corpus callosum: anterior, middle, posterior)		Continuous (GPSs and GVSs)	Correlation coefficients and p-values
3. Mann-Whitney U	Dichotomous (Subcortical structures: lenticular nucleus, caudate nucleus, PLIC, thalamus, brainstem; Corpus callosum: anterior, middle, posterior)		Continuous (GPSs and GVSs)	p-values
4. Kruskal-Wallis (with post-hoc Mann-Whitney U)^b	Continuous (Global total; adjusted global total; global total hemispheric; global total subcortical; laterality hemispheres)		Nominal (MJ patterns)	p-values
5. Pearson chi-squared	Ordinal (Total corpus callosum; total cerebellum; lobes: frontal, parietal, temporal, occipital; layers: PV, M, CSC)	Ordinal (GMFCS)	Nominal (MJ patterns)	χ^2 , p-values and Cramer's V, interpreted based on DF
	Dichotomous (Subcortical structures: lenticular nucleus, caudate nucleus, PLIC, thalamus, brainstem; Corpus callosum: anterior, middle, posterior)			<p>For DF=1: i) Weak association if $0.10 < V < 0.30$ ii) Moderate association if $0.30 < V < 0.50$ iii) Strong associations if $V > 0.50$</p> <p>For DF=2: i) Weak association if $0.07 < V < 0.21$ ii) Moderate association if $0.21 < V < 0.35$ iii) Strong associations if $V > 0.35$</p>

sqMRI, semi-quantitative MRI scale [1]; PV, Periventricular; M, middle white matter; CSC, cortico/subcortical; PLIC, posterior limb of internal capsule; GMFCS, gross motor function classification system; GPS, gait profile score; GVS, gait variable score; MJ, multiple-joint; DF, degrees of freedom [2]; ^a the GPSs and GVSs within each 0 or 1 score had to be normally distributed, when normality was not met, a Mann-Whitney U test was performed; ^b $\alpha = 0.017$.

Table S2. General patients' characteristics and between group comparisons.

		Total (N=104)	bCP (n=52)	uCP (n=52)	p (MWU)	p (χ^2)
Age at 3DGA [years]	Median (IQR)	5.89 (5.09 - 6.88)	5.64 (5.02 - 6.68)	6.01 (5.29 - 7.11)	0.109	
Age at MRI [years]	Median (IQR)	8.38 (5.44 - 10.79)	6.78 (5.44 - 9.70)	9.79 (5.67 - 11.84)	0.015*	
Gender						0.689
	Boys [n (%)]	62 (59.6%)	32 (61.5%)	30 (57.7%)		
	Girls [n (%)]	42 (40.4%)	20 (38.5%)	22 (42.3%)		
Weight (kg)	Median (IQR)	18.85 (16.73 - 21.83)	17.9 (16.05 - 20.33)	20.55 (18.05 - 23.27)	$\leq 0.001^*$	
Height (m)	Median (IQR)	1.14 (1.06 - 1.21)	1.12 (1.04 - 1.17)	1.17 (1.09 - 1.23)	0.004*	
BoNT-A						0.005*
	0 [n (%)]	53 (51%)	21 (40.4%)	32 (61.5%)		
	1 [n (%)]	23 (22.1%)	9 (17.3%)	14 (26.9%)		
	2 [n (%)]	21 (20.2%)	16 (30.8%)	5 (9.7%)		
	3 [n (%)]	7 (6.7%)	6 (11.5%)	1 (1.9%)		
Composite spasticity^a (0-16)	Median (IQR)	4 (3 - 5.5)	5.25 (3.5 - 6.5)	3.5 (2.5 - 4.5)	$\leq 0.001^*$	
Composite weakness^a (0-30)	Median (IQR)	22 (20 - 23) ^b	21.5 (19 - 23) ^c	22 (20 - 24) ^d	0.132	
Composite selectivity^a (0-12)	Median (IQR)	10.5 (8.5 - 11.25) ^b	9.5 (8.5 - 11) ^c	10.5 (9 - 11.5) ^d	0.405	
Composite passive ROM^a (0-6)	Median (IQR)	2 (1 - 3)	2.5 (1 - 4)	1 (1 - 2)	0.007*	
Comorbidities						
	Visual impairment					0.018*
	Yes [n (%)]	48 (46.2%)	30 (57.7%)	18 (34.6%)		
	No [n (%)]	56 (53.8%)	22 (42.3%)	34 (65.4%)		
	Hearing impairment					1.000
	Yes [n (%)]	8 (7.7%)	4 (7.7%)	4 (7.7%)		
	No [n (%)]	96 (92.3%)	48 (92.3%)	48 (92.3%)		
	Intellectual impairment					0.139
	Yes [n (%)]	11 (10.6%)	7 (13.5%)	4 (7.7%)		
	No [n (%)]	58 (55.8%)	24 (46.1%)	34 (65.4%)		
	Unknown [n (%)]	35 (33.6%)	21 (40.4%)	14 (26.9%)		
	Epilepsy					0.222
	Yes [n (%)]	21 (20.2%)	8 (15.4%)	13 (25%)		
	No [n (%)]	83 (79.8%)	44 (84.6%)	39 (75%)		
Physical therapy						1.000
	Yes [n (%)]	100 (100%)	100 (100%)	100 (100%)		
	No [n (%)]	0	0	0		
Sessions per week	Median (IQR)	3 (2 - 3)	3 (2 - 3,8)	2 (2 - 3)	0.043*	
Duration (in minutes)	Median (IQR)	45 (30 - 60)	60 (30 - 60)	30 (30 - 60)	0.028*	
Day orthoses						0.135
	Yes [n (%)]	84 (80.8%)	39 (75%)	45 (86.5%)		
	No [n (%)]	20 (19.2%)	13 (25%)	7 (13.5%)		
Night Ortheses						0.689
	Yes [n (%)]	42 (40.4%)	22 (42.3%)	20 (38.5%)		
	No [n (%)]	62 (59.6%)	30 (57.7%)	32 (61.5%)		

*p < 0.05; bCP, bilateral cerebral palsy; uCP, unilateral cerebral palsy; MWU, Mann-Whitney U test; χ^2 , Pearson chi squared; 3DGA, three-dimensional gait analysis; IQR, interquartile range; MRI, magnetic resonance imaging; BoNT-A, botulinum toxin type A treatments; ROM, range of motion; ^acomposite scores are defined based on [3]; ^bn=69; ^cn=31; ^dn=38.

Table S3. Brain lesion scores and between group comparisons.

		Total (N=104)	bCP (n=52)	uCP (n=52)	p (MWU)	p (χ^2)
MRICS						0.126
	Maldevelopment [n (%)]	2 (1.9%)	1 (1.9%)	1 (1.9%)		
	Predominant white matter injury [n (%)]	76 (73.1%)	42 (80.8%)	34 (65.4%)		
	Predominant grey matter injury [n (%)]	17 (16.3%)	4 (7.7%)	13 (25%)		
	Miscellaneous changes [n (%)]	9 (8.7%)	5 (9.6%)	4 (7.7%)		
Lesion extent scores						
Global (0-40)	Median (IQR)	12 (7.5 - 16.5) ^b	13 (7.38 - 16.13) ^c	11.5 (7.75 - 17) ^d	0.721	
Adjusted global (0-37) ^a	Median (IQR)	11 (7.25 - 15) ^e	13.5 (7.88 - 15.75) ^f	10 (4.5 - 11) ^g	0.079	
Total hemispheric (0-24)	Median (IQR)	9.5 (5.5 - 12.5)	10 (6.63 - 12.88)	7.5 (4.5 - 11.88)	0.015*	
Total subcortical (0-10)	Median (IQR)	1 (0 - 3)	0 (0 - 2)	2 (0 - 4)	$\leq 0.001^*$	
Corpus callosum (0-3)	Median (IQR)	1 (0 - 2) ^b	1 (0 - 2) ^c	1 (0 - 2) ^d	0.802	
Cerebellum (0-3)	Median (IQR)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	0.530	
Laterality hemispheres	Median (IQR)	0.11 (0.04 - 0.63)	0.04 (0.0 - 0.08)	0.62 (0.19 - 1)	$\leq 0.001^*$	
Lesion location scores of the most affected brain side						
Frontal lobe (0-3)	Median (IQR)	1.5 (1 - 1.5)	1.5 (1 - 1.5)	1.25 (1 - 2)		0.008*
Parietal lobe (0-3)	Median (IQR)	1.5 (1.5 - 2)	1.5 (1.5 - 2)	1.5 (1.13 - 2.88)		0.072
Temporal lobe (0-3)	Median (IQR)	1.5 (0.5 - 2)	1.5 (0.5 - 1.88)	1.5 (0.5 - 2)		0.111
Occipital lobe (0-3)	Median (IQR)	1.5 (0.5 - 2)	1.5 (0.5 - 2)	1.5 (0.5 - 2)		0.068
PV layer (0-4)	Median (IQR)	3.5 (2 - 4)	3.5 (2.63 - 4)	3 (2 - 4)		0.742
M layer (0-4)	Median (IQR)	2 (1.5 - 3)	2 (1.5 - 2.88)	2 (1.5 - 3)		0.599
CSC layer (0-4)	Median (IQR)	0 (0 - 0.5)	0 (0 - 0)	0 (0 - 2.38)		0.191
Lenticular nucleus (0-1)						$\leq 0.001^*$
	Intact [n (%)]	84 (80.8%)	49 (94.2%)	34 (65.4%)		
	Involved [n (%)]	20 (19.2%)	3 (5.8%)	18 (34.6%)		
Caudate nucleus (0-1)						0.402
	Intact [n (%)]	90 (86.5%)	46 (88.5%)	43 (82.7%)		
	Involved [n (%)]	14 (13.5%)	6 (11.5%)	9 (17.3%)		
PLIC (0-1)						$\leq 0.001^*$
	Intact [n (%)]	63 (60.6%)	42 (80.8%)	20 (38.5%)		
	Involved [n (%)]	41 (39.4%)	10 (19.2%)	32 (61.5%)		
Thalamus (0-1)						0.073
	Intact [n (%)]	63 (60.6%)	35 (67.3%)	26 (50%)		
	Involved [n (%)]	41 (39.4%)	17 (32.7%)	26 (50%)		
Brainstem (0-1)						$\leq 0.001^*$
	Intact [n (%)]	73 (70.2%)	48 (92.3%)	24 (46.2%)		
	Involved [n (%)]	31 (29.8%)	4 (7.7%)	28 (53.8%)		
Anterior part of corpus callosum (0-1)						0.898
	Intact [n (%)]	65 (78.3%) ^b	30 (57.7%) ^c	35 (67.3%) ^d		
	Involved [n (%)]	18 (21.7%) ^b	8 (15.4%) ^c	10 (19.2%) ^d		
Middle part of corpus callosum (0-1)						0.734
	Intact [n (%)]	41 (49.4%) ^b	18 (34.6%) ^c	23 (44.2%) ^d		
	Involved [n (%)]	42 (50.6%) ^b	20 (38.5%) ^c	22 (42.3%) ^d		
Posterior part of corpus callosum (0-1)						0.703
	Intact [n (%)]	28 (33.7%) ^b	12 (23.1%) ^c	16 (30.8%) ^d		
	Involved [n (%)]	55 (66.3%) ^b	26 (50%) ^c	29 (55.7%) ^d		

*p < 0.05; bCP, bilateral cerebral palsy; uCP, unilateral cerebral palsy; MWU, Mann-Whitney U test; χ^2 , Pearson chi squared; MRICS, magnetic resonance imaging classification system [4]; IQR, interquartile range; PLIC, posterior limb of internal capsule; PV, periventricular; M, middle white matter; CSC, cortico/subcortical; ^aglobal score when sagittal view MRI was missing; ^bn=83; ^cn=38; ^dn=45; ^en=21; ^fn=14; ^gn=7.

Table S4. Gait scores and between group comparisons.

	Total (N=104)	bCP (n=51)	uCP (n=53)	p (MWU)	p (χ^2)
GMFCS					$\leq 0.001^*$
I [n (%)]	64 (61.5%)	19 (36.6%)	45 (86.5%)		
II [n (%)]	30 (28.9%)	23 (44.2%)	7 (13.5%)		
III [n (%)]	10 (9.6%)	10 (19.2%)	0 (0%)		
GPS	Median (IQR)	8.03 (6.64 - 9.67)	9.10 (7.24 - 11.46)	7.32 (6.17 - 8.52)	$\leq 0.001^*$
GPS - sagittal	Median (IQR)	8.96 (7.33 - 11.53)	10.22 (8.34 - 12.83)	8.05 (6.52 - 9.52)	$\leq 0.001^*$
GPS - coronal	Median (IQR)	3.58 (2.74 - 5.11)	3.77 (3.08 - 5.27)	3.39 (2.21 - 4.48)	0.059
GPS - transverse	Median (IQR)	7.67 (5.92 - 11.30)	7.97 (6.16 - 12.74)	7.40 (5.83 - 10.21)	0.214
GVS - pelvis sagittal	Median (IQR)	4.79 (2.93 - 7.40)	5.76 (3.14 - 9.51)	4.42 (2.82 - 6.26)	0.036*
GVS - hip sagittal	Median (IQR)	6.82 (5.13 - 10.47)	8.53 (5.61 - 11.02)	6.09 (5.06 - 9.01)	0.036*
GVS - knee sagittal	Median (IQR)	12.19 (9.15 - 15.11)	14.21 (10.69 - 17.75)	10.55 (7.46 - 12.76)	$\leq 0.001^*$
GVS - ankle sagittal	Median (IQR)	7.83 (6.03 - 10.52)	8.62 (6.22 - 11.78)	7.41 (5.88 - 9.39)	0.123
GVS - pelvis coronal	Median (IQR)	2.56 (1.71 - 4.07)	3.17 (1.99 - 4.53)	2.10 (1.61 - 3.76)	0.012*
GVS - hip coronal	Median (IQR)	4.17 (3.08 - 5.67)	4.18 (3.26 - 5.71)	4.16 (2.38 - 5.47)	0.205
GVS - pelvis transverse	Median (IQR)	5.24 (3.54 - 8.05)	5.64 (3.35 - 8.64)	5.09 (3.59 - 7.56)	0.585
GVS - hip transverse	Median (IQR)	7.45 (5.13 - 11.03)	7.50 (5.35 - 11.34)	7.45 (4.92 - 10.41)	0.876
GVS - foot transverse	Median (IQR)	7.84 (4.44 - 13.98)	8.25 (4.54 - 16.58)	6.95 (4.13 - 11.85)	0.269
Laterality GPS	Median (IQR)	0.07 (0.03 - 0.1)			
Laterality GPS - sagittal	Median (IQR)	0.05 (0.02 - 0.1)			
Laterality GPS - coronal	Median (IQR)	0.11 (0.07 - 0.21)			
Laterality GPS - transverse	Median (IQR)	0.13 (0.05 - 0.22)			
Multiple joint patterns					0.038*
Minor [n (%)]	22 (21.1%)	6 (11.5%)	16 (30.8%)		
Extension [n (%)]	50 (48.1%)	30 (57.7%)	20 (38.4%)		
Flexion [n (%)]	32 (30.8%)	16 (30.8%)	16 (30.8%)		

*p < 0.05; bCP, bilateral cerebral palsy; uCP, unilateral cerebral palsy; MWU, Mann-Whitney U test; χ^2 , Pearson chi squared; GMFCS, gross motor function classification system; GPS, gait profile score; GVS, gait variable score; IQR, interquartile range.

Table S5. Pearson chi-squared associations between the thalamus and GMFCS in children with uCP.

	Thalamus	
	0	1
χ^2	4.13 ^{a*}	
V	0.282 ^b	
ASRs		
GMFCS I	2.0	-2.0
GMFCS II	-2.0	2.0

* $p \leq 0.05$; GMFCS, gross motor function classification system; uCP, unilateral cerebral palsy; χ^2 , Pearson chi squared; V, Cramer's V, indicating a significantly weak association based on the degrees of freedom (DF) explained in Supplementary Table S1 [2]; ASRs, adjusted standardized residuals; ^aresults should be interpreted with caution because >20% of cells had expected frequencies lower than n=5; ^bDF=1.

Table S6. Pearson chi-squared associations between brain lesion extent scores and the multiple joint patterns in the total, bCP and uCP groups.

	Corpus callosum ^a			
	0	1	2	3
χ^2	15.20*			
V	0.303 ^c			
ASRs				
Minor			2.3	-2.0
Extension		2.3	-2.9	
Flexion	-2.4			
χ^2	18.51 ^{b**}			
V	0.404 ^c			
ASRs				
Minor				
Extension		2.2	-3.0	
Flexion				2.5

* $p \leq 0.05$; ** $p \leq 0.01$; bCP, bilateral cerebral palsy; uCP, unilateral cerebral palsy; χ^2 , Pearson chi squared; V, Cramer's V, indicating significantly moderate (gray) and stronger (darker gray) associations based on the degrees of freedom (DF) explained in Supplementary Table S1 [2]; ASRs, adjusted standardized residuals; PV, Periventricular; ^an_{total}=83, n_{bCP}=38, n_{uCP}=45; ^bresults should be interpreted with caution because >20% of cells had expected frequencies lower than n=5; ^cDF=2.

Table S7. Pearson chi-squared associations between brain lesion location scores and the multiple joint patterns in the total, bCP and uCP groups.

	Frontal lobe								PV layer								Anterior Corpus callosum ^a		Middle Corpus callosum ^a			
	0	0.5	1	1.5	2	2.5	3	3.5	4	0	0.5	1	1.5	2	2.5	3	3.5	4	0	1	0	1
Total	χ^2									32.56 ^{b**}												
	V									0.396 ^c												
	ASRs																					
	Minor																					
bCP	Extension											2.7		-2.7								
	Flexion												2.3		2.3							
	χ^2									23.74 ^{b*}												
	V									0.478 ^c												
uCP	ASRs											2.8		-2.5								
	Minor												2.5		2.2							
	Extension																					
	Flexion																					
	χ^2	25.09 ^{b*}																	6.78 ^{b*}		12.47 ^{**}	
	V	0.491 ^c																	0.388 ^d		0.526 ^d	
	ASRs																					
	Minor		2.0	-2.6																		
	Extension				3.0	-2.6															3.0	-3.0
	Flexion						2.2														-3.1	3.1

* $p \leq 0.05$; ** $p \leq 0.01$; bCP, bilateral cerebral palsy; uCP, unilateral cerebral palsy; PV, Periventricular; χ^2 , Pearson chi squared; V, Cramer's V, indicating significantly moderate (gray) and stronger (darker gray) associations based on the degrees of freedom (DF) explained in Supplementary Table S1 [2]; ASRs, adjusted standardized residuals; ^an_{total}=83, n_{bCP}=38, n_{uCP}=45; ^bresults should be interpreted with caution because >20% of cells had expected frequencies lower than n=5; ^cDF=2; ^dDF=1.

References

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