P-19. Analysis of Brain Regional Volumetry Using NeuroQuant in Healthy Korean Adults

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Introduction

• This study aimed to investigate the patterns of brain regional volumetry by age group and hemispheric dominance using NeuroQuant.

Methods

• Forty-six healthy adults participated in this study. All participants underwent neurological examinations and screening tests. Inclusion criteria included age over 20 years and no history of neurological disorders. Structural brain magnetic resonance imaging (MRI) was performed using NeuroQuant. Handedness was assessed using the Edinburgh Handedness Inventory, and motor function was evaluated through grip strength and the 9-Hole Peg Test. For analysis, participants were divided into two age groups: 20-50 years and over 50 years.

Results

• Of the 46 participants, 24 were in the 20-50 age group and 22 were in the over-50 age group (Table 1).

Table 1. Demographic characteristic

	Total(N=46)	Age 20-50(N=24)	Age 50 over(N=22)	p value
sex(Male:Female)	13:33 [28.3%:71.7%]	5:19	8:14	0.243
Patient_Age	48.70±16.88	34.88±9.15	63.77±7.92	0.000
dom_edin(Lt:Rt)	16:30 (34.8%:65.2%)	11:13	5:17	0.100
Lt_edin	6.46±8.00	8.67±8.66	4.05±6.57	0.033
Rt_edin	13.54±8.00	11.33±8.66	15.95±6.57	0.033
Lt_gp	31.07±10.64	31.13±9.58	31.00±11.92	0.668
Rt_gp	31.71±11.02	31.36±10.09	32.09±12.19	0.676
Lt_ghole	22.25±4.28	21.30±3.64	23.29±4.76	0.206
Rt_ghole	21.65±3.18	21.40±3.46	21.93±2.91	0.312

• Right-handedness was more common than left-handedness according to the Edinburgh Handedness Inventory. No significant differences were observed between the age groups in grip strength or the 9-Hole Peg Test. Regional brain volumetry analysis revealed that the volumes of the anterior cingulate cortex, medial orbitofrontal cortex, pars triangularis, and the third and fifth ventricles were significantly smaller in the dominant hemisphere than in the non-dominant hemisphere (Table 2).
• Conversely, the volume of the supramarginal gyrus was significantly larger in the dominant hemisphere.
•Age-related analysis showed that cortical regions, including the frontal, temporal, and parietal lobes, and subcortical structures, such as the hippocampus, putamen, pallidum, and nucleus accumbens, were significantly reduced in the over-50 group compared to the younger group. In contrast, the volumes of the ventricles and choroid plexus were increased in the over-50 group (Table 3). Notably, the cingulate cortex and limbic regions, including the entorhinal cortex, were relatively preserved despite aging.

Table 2. The differences of brain regional volume between the dominant and non-dominant hemisphere

	Dominant hemisphere	Non-dominant hemisphere	Δ Non-dominant - Dominant	p value
Caudal_Anterior_Cingulate	1.10±0.49	1.32±0.47	0.22	0.032
Anterior_Cingulate	2.71±1.00	3.22±0.97	0.50	0.016
5th_Ventricle	0.03±0.03	0.06±0.05	0.03	0.001
Medial_Orbitofrontal	5.64±1.73	6.52±1.65	0.88	0.014
Pars_Triangularis	4.38±1.13	5.01±1.12	0.62	0.009
Rostral_Anterior_Cingulate	1.61±0.57	1.83±0.58	0.29	0.019
Supramarginal	11.23±2.30	10.01±2.50	-1.09	0.032
3rd_Ventricle	0.64±0.34	0.83±0.44	0.21	0.023

Table 3. The differences of brain regional volume between the age 20-50 group and 50 over group

	Age 20-50(N=24)	Age 50 over(N=22)	Δ Age 50 over - 20-50 groups	p value
Amygdala	4.21±0.73	3.29±0.56	-0.92	0.000
Anterior Middle Frontal	16.93±2.87	14.98±2.17	-1.95	0.013
Posterior Superior Temporal Sulcus	0.47±0.14	0.64±0.28	0.16	0.019
Basal Ganglia	20.93±2.13	17.94±1.80	-2.99	0.000
Brainstem	22.65±2.62	23.94±2.95	1.29	0.147
Caudal Anterior Cingulate	2.30±0.42	2.57±0.56	0.28	0.061
Anterior Cingulate	5.87±0.85	6.00±0.86	0.13	0.601
Caudate	5.64±0.69	5.02±0.57	-0.61	0.002
Cerebellar Gray Matter	103.06±7.91	102.40±13.32	-0.66	0.840
Cerebellar White Matter	30.98±3.33	30.14±4.11	-0.84	0.449
Cerebellum	134.04±8.32	132.54±15.76	-1.50	0.692
Cingulate	13.62±1.14	14.71±1.79	1.09	0.017
Corpus Callosum	0.86±0.19	1.43±0.43	0.58	0.000
Cuneus	12.89±2.22	11.95±1.94	-0.94	0.137
Entorhinal Cortex	5.50±1.06	6.35±0.98	0.85	0.005
5th Ventricle	0.07±0.03	0.10±0.04	0.03	0.016
Forebrain Parenchyma	1051.84±97.93	1004.55±108.60	-47.34	0.127
4th Ventricle	1.62±0.38	1.73±0.38	0.11	0.342
Frontal Lobe	196.33±23.58	174.81±20.41	-21.51	0.002
Frontal Pole	4.64±1.02	4.18±0.74	-0.46	0.344
Fusiform	23.64±2.42	23.05±2.82	-0.59	0.449
Cortical Gray Matter	544.03±61.20	502.85±51.94	-41.18	0.027
Hippocampus	8.47±0.68	7.83±1.44	-0.64	0.065
ILV Choroid Plexus	0.98±0.23	1.50±0.40	0.54	0.000
Inferior Frontal	32.31±4.59	28.19±3.57	-4.12	0.001
Inferior Lateral Ventricle	1.35±0.41	1.82±0.56	0.48	0.000
Inferior Parietal	32.72±4.16	30.35±5.14	-2.36	0.092
Inferior Temporal	21.44±3.02	20.69±3.12	-0.75	0.129
Intracranial Volume	1540.60±123.11	1512.12±143.90	-28.49	0.473
Isthmus Cingulate	5.02±0.59	5.19±0.89	0.17	0.447
LLV Choroid Plexus	7.21±1.72	8.63±1.22	1.60	0.002
Lateral Occipital	27.66±4.79	26.57±3.57	-1.09	0.389
Lateral Orbitofronta	20.34±2.44	18.61±2.28	-1.72	0.018
Superior Lateral Ventricle	19.99±11.88	27.73±9.53	7.74	0.003
Lingual	18.22±2.41	18.48±2.74	0.26	0.729
Medial Occipital	34.10±4.85	33.19±4.37	-0.92	0.506
Medial Orbitofrontal	12.67±1.16	11.61±1.69	-1.05	0.017
Medial Parietal	23.12±3.43	21.28±3.91	-1.84	0.096
Middle Frontal	29.12±4.39	26.20±4.38	-2.92	0.019
Middle Temporal	30.75±4.56	29.71±5.29	-1.04	0.478
Nucleus Accumbens	1.37±0.29	1.19±0.19	-0.18	0.036
Occipital Lobe	61.77±9.15	59.76±7.25	-2.01	0.417
Pallidum	1.71±0.20	1.14±0.27	-0.57	0.000
Paracentral	10.5±1.86	8.77±1.65	-1.53	0.014
Parahippocampal	5.00±0.50	5.03±1.10	0.03	0.333
Parietal Lobe	131.15±16.53	118.68±18.06	-12.47	0.017
Pars Opercularis	13.03±1.78	11.43±1.58	-1.59	0.000
Pars Orbitalis	8.93±1.51	8.20±1.06	-0.73	0.048
Pars Triangularis	5.88±1.32	8.85±1.33	-1.03	0.038
Pericalcarine	3.00±0.60	2.75±0.63	-0.24	0.186
Posterior Cingulate	4.74±0.44	3.53±1.48	-0.79	0.000
Premotor	12.19±2.12	11.22±2.75	-0.97	0.071
Primary Motor	29.61±3.56	25.66±2.59	-3.96	0.000
Primary Sensory	24.31±3.66	22.36±3.70	-1.95	0.080
Putamen	5.22±0.45	3.93±0.53	-1.29	0.000
Rostral Anterior Cingulate	3.57±0.62	3.43±0.57	-0.15	0.412
Superior Frontal	58.36±7.30	52.03±6.75	-6.33	0.008
Superior Parietal	38.62±5.48	34.89±5.86	-3.73	0.003
Superior Temporal	27.04±3.96	25.13±3.17	-1.92	0.060
Supramarginal	22.46±2.27	20.92±3.46	-1.56	0.098
Temporal Lobe	146.97±14.61	138.53±20.25	-8.44	0.110
Temporal Pole	8.52±1.15	8.36±1.27	-0.16	0.638
Thalamus	16.05±2.06	15.36±2.33	-0.69	0.290
3rd Ventricle	1.20±0.33	1.80±0.43	0.60	0.000
Ventricle	24.55±12.93	33.13±10.28	8.44	0.002
Transverse Temporal	1.37±0.27	1.27±0.30	-0.10	0.236
Transverse Temporal + Superior Temporal	36.37±5.18	33.60±6.32	-5.58	0.003
Ventral Diencephalon	7.34±0.58	6.46±1.20	-0.87	0.004
Cerebral White Matter	450.42±41.00	449.94±45.05	-0.48	0.970
Cerebral WM Hypointensities	2.32±0.36	0.84±1.74	0.45	0.017
Whole Brain	1208.53±101.99	1160.98±123.64	-47.55	0.160

Conclusion

• This study demonstrated that brain regional volumes, as measured by NeuroQuant, were generally smaller in the dominant hemisphere compared to the non-dominant hemisphere. Consistent with previous research, aging was associated with significant reductions in cortical and subcortical volumes and increases in ventricular and choroid plexus volumes. However, the cingulate cortex and limbic regions appeared to be relatively spared in the aging process.