Contralateral brain atrophy in conservatively treated primary intracerebral hemorrhage

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Brain volume loss after cerebrovascular accident

- Cortical gray matter loss induced by neurodegenerative change
- Risk factor of neurodegenerative disease
- Suffering from dementia and cognitive defecit after minor TBI(trumatic brain injury) & CVA

Patients & Methods

- Total 2213 Patients**
 - Jan. 2010 - Dec. 2017
 - primary ICH were admitted our institute
- Inclusion Criteria**
 - Unilateral ICH
 - Supratentorial ICH
 - Presence of initial & 3 months ~ 1yrs follow up brain CT scan
 - No evidence of surgical intervention
 - No History of brain disease
- 46 patients included in this study**
- Serial axial images of initial and f/u brain CT scans, respectively;**
- Voxel based volume calculation**

Fig. Brain volume measurement method.
Pixels counted using semi-automatic image segmentation in each plane, axial sequence image with the foramen of Monro level (horizontal red line) as the lower boundary, and the vertex (red arrow) as the upper boundary (average: approximately 14 images).
Yellow line shows the true parenchymal volume along with brain cortical margin.

Follow-up CT pixel count/Initial CT pixel count
→volume ratio change

Result

Characteristic	Number of patients (%)
Clinical characteristics	
Age in years	
; median(range)	56(31-83)
Sex	
Male	21(45.6%)
Female	25(54.4%)
Interval of follow-up brain CT(months)	
; median(range)	6(3-12)
Presence of underlying disease	
Diabetes mellitus	7(15.2%)
Hypertension	18(39.1%)
Current smoker	7(15.2%)
GCS on arrival	
≤12	10(21.7%)
>13	36(78.3%)
GOS after 6month	
≤3	9(19.5%)
4	26(56.5%)
5	11(23.9%)
Radiological characteristics	
Volume of ICH(cm³)	
;mean(range)	12.21 (1.8-33.02)
< 5	14(30.4%)
5-10	11(23.9%)
10-20	10(21.7%)
> 20	11(23.9%)
Side of ICH	
Rt. hemisphere	24(52.1%)
Lt. hemisphere	22(47.9%)
Location of ICH	
Basal ganglia	30(65.2%)
Thalamus	9(19.5%)
Cortex(subcortex)	7(15.2%)
Presence of IVH	5(10.8%)

Contralateral parenchymal volume ratios at follow-up brain CT scanning

- Mean change percentage between the initial and follow-up contralateral parenchyma volume was **96.84%** (range 86.08–102.63)
- The average contralateral parenchyma volume ratio decreased by **3.16%** (**P-value = 0.001**).
- Normal aging process was reported to be 0.32% per year throughout all ages
- In the univariate, multivariate logistic regression model, no factors were associated with contralateral brain volume loss

Discussion

Diaschisis

- The changes of structural and functional connectivity between brain areas distant to the lesion
- Connectivity studies about the impact of a focal lesion on distant connections and its behavioural consequences.

Secondary neurodegeneration

- vasogenic edema, excitotoxicity, remote atrophy, selective neuronal loss, diaschisis, and microglial activation loss

CONCLUSION

- Contralateral parenchymal volumes were significantly decreased on the brain CT scan at 1-year follow-up
- These morphological changes provided important clinical information on the remote effect of focal lesion and symptoms in the course of ICH treatment