Virginia Institute of Neuropsychiatry

Longitudinal Volumetric Analysis based on NeuroQuant® data

Patient: Location of MRIs:

Date of MRIs: 04/25/2011 & 05/05/2012 Date of report:

Region	LH annual % change	LH %tile rank	RH annual % change	RH %tile rank
Whole Brain Parenchyma	-0.725%	16.4%	-1.575%	6.3%
Forebrain Parenchyma	-0.780%	15.4%	-1.662%	**3.8%***
Cortical Gray Matter	0.483%	77.3%	-0.746%	60.8%
Cerebral White Matter	-2.707%	6.0%	-2.960%	**4.6%***
Lateral Ventricle	10.136%	**99.3%***	1.378%	31.4%
Inferior Lateral Ventricle	-15.785%	0.1%	-5.661%	22.6%
Total CSF	8.730%	**98.8%***	0.343%	23.5%
Caudate	10.710%	98.1%	2.278%	65.7%
Putamen	-2.738%	32.9%	0.738%	59.0%
Pallidum	-20.102%	6.1%	-6.543%	26.8%
Thalamus	7.701%	98.4%	-0.055%	44.3%
Amygdala	-5.539%	19.3%	-5.280%	16.3%
Hippocampus	2.239%	87.8%	1.583%	72.7%
Cerebellum	-0.769%	23.5%	-1.565%	24.2%
Brain Stem	1.835%	85.4%	1.693%	77.1%

Whole Brain Parenchyma (L+R)	L+R % Change	%tile rank
	-1.154%	8.9%

Note: t2 = volume during 2d MRI. t1 = volume during 1st MRI. LH = left hemisphere. RH = right hemisphere. %tile = normative percentile.

"—" indicates that the data were unreliable due to artifact.

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"*" and **bold** font indicates a normative percentile which was statistically and clinically significant, defined as any of the following:

- A reduction of parenchymal volume ≤ 5th normative percentile, indicating atrophy
- An enlargement of ventricular volume ≥ 95th normative percentile, consistent with atrophy of the surrounding parenchyma

Summary of positive findings: Abnormal volumes consistent with parenchymal atrophy were found in the following regions:

* The right forebrain parenchyma atrophied significantly.
* The right cerebral white matter atrophied significantly.
* The left lateral ventricle enlarged significantly.
* The left total cerebrospinal fluid volume enlarged significantly.

Methods for NeuroQuant® Longitudinal Analysis

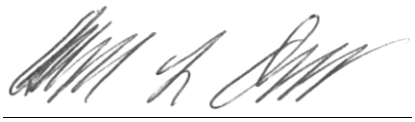
The purpose of this longitudinal analysis was to compare the change in brain volume over time for the patient vs. a group of normal control subjects. For the patient and each normal control, brain volume was measure at two points in time. For the patient, a NeuroQuant® Extended Analysis was done for each of the two MRIs. (See the Introduction sections of those two reports for further explanation). The Longitudinal Analysis is a follow up analysis based on the results of the two previous extended analyses. Whereas the purpose of the Extended Analysis was to test for atrophy of brain parenchymal regions and enlargement of ventricular regions *at one point in time*, the purpose of the Longitudinal Analysis was to test for *progressive* atrophy of brain parenchymal regions and enlargement of ventricular regions by examining *two points in time*. Multiple previous studies have found that the longitudinal design is a powerful and valid one for detecting differences between patients with traumatic brain injury and normal controls (Ross, in press).

The Longitudinal Analysis compared the same brain regions that were compared in the two previous extended analyses, using the same normal control group. Each normal control had 2 MRI scans done, with a mean interscan interval of 13.0 months (SD 0.8). There were 10 men and 10 women. The mean age at scan 1 was 68.3 years (SD 3.6 years; range 60.0-71.5). The mean age at scan 2 was 69.3 years (SD 3.6 years; range 61.1-72.6). The NeuroQuant® Standard Analysis was done for each of the normal controls at time 1 and time 2.

The longitudinal changes in brain volume for each brain region were calculated as follows:

- For each brain region, the difference in volume between time 1 and 2 was calculated (=BRV2-BRV1).

- Each volume difference was “corrected for” or compared to initial brain region volume by dividing the volume difference by initial brain region volume (=[BRV2-BRV1]/BRV1), and the result was expressed as a percentage.
- The percentage change in brain volume region was annualized by computing the rate of volume change per year, thereby correcting for differences between interscan intervals.
- For each brain region, the annualized percentage change in brain volume for the patient was compared to the normal controls and a percentile rank was calculated.



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Reference

Ross, D. E. (2011). "Review of longitudinal studies of MRI brain volumetry in patients with traumatic brain injury." Brain Injury **25**(13-14): 1271-1278.

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