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# Longitudinal Assessment of Traumatic Brain Injury Using NeuroQuant®

A Case Study with Dr. Suzie Bash at RadNet

## Clinical Background

A 71-year-old female presented with a history of repeated head trauma, the most recent of which occurred after hitting her head on a kitchen cabinet.

She underwent imaging to assess the extent of injury, and longitudinal follow-up was conducted using quantitative MRI with NeuroQuant® analysis.

## 1. Initial Imaging Findings (CT)

The patient's non-contrast head CT revealed:

- **Acute right-sided subdural hematoma**, tracking along the right superior tentorial leaf and right parafalcine region
- **Minor parenchymal hemorrhage** in the right occipital lobe
- **Mass effect and midline shift** with asymmetric sulcal narrowing in the right cerebrum

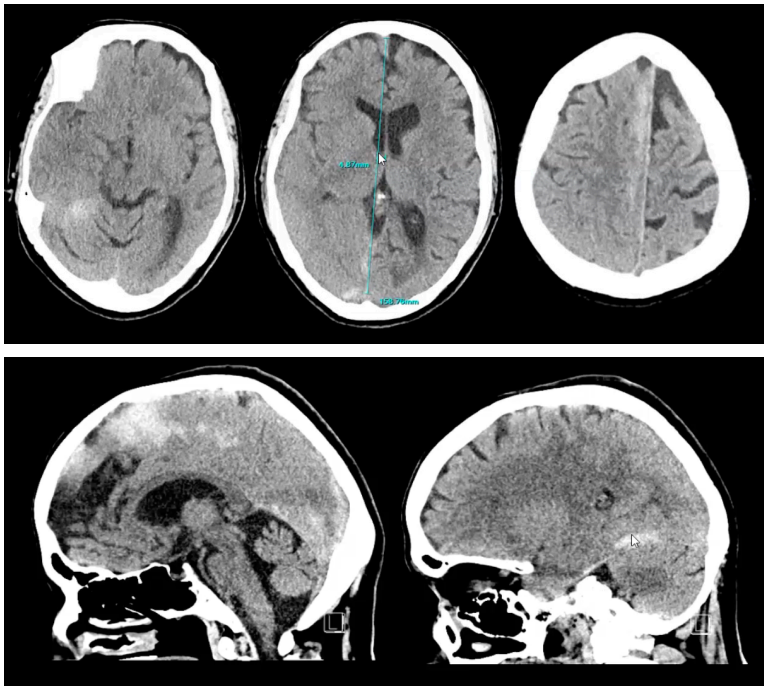


**Figure 1.** Patient's non-contrast head CT

# 2. Follow-Up Imaging

## MRIs obtained 5 & 7 months later

Despite resolution of the acute findings, the follow-up MRIs revealed the imaging residua of old:

- **Superficial siderosis** with old subarachnoid hemosiderin staining noted throughout several sulci in the left cerebral hemisphere
- **Macrohemorrhages and microhemorrhages** visible on the GRE sequences
- **Post-traumatic cortical encephalomalacia** and surrounding gliosis
- **Asymmetric cerebral atrophy**, with a left temporal predilection

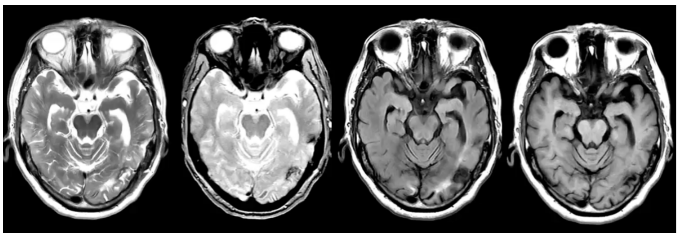


**Figure 2.** MRI of the brain obtained 5 months after the initial CT demonstrated interval resolution of all acute findings (including resolution of the right-sided subdural hematoma and acute parenchymal bleed). This MRI now demonstrates the imaging residua of old left-sided superficial siderosis, macrohemorrhages and microhemorrhages which were not present on the initial CT. There has also been interval development of post-traumatic cortical encephalomalacia, gliosis, and left temporal cerebral atrophy, as seen on the axial T2, axial GRE, axial FLAIR, and axial T1 [left to right].

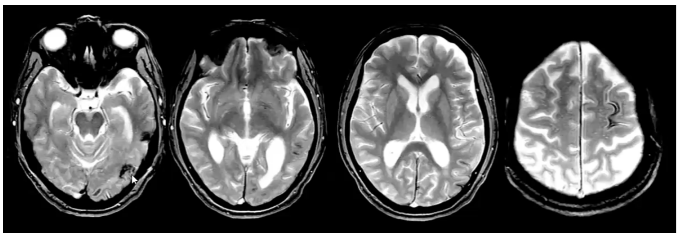


**Figure 3.** MRI of the brain obtained 7 months after the initial CT demonstrates no interval change, with multifocal old hemosiderin staining again noted, including the imaging residua of old superficial siderosis, macrohemorrhages, and microhemorrhages, as seen on these axial GRE images.

# 3. Quantitative MRI Analysis Using NeuroQuant® TBI

## The patient's imaging was post-processed with the NeuroQuant® Triage Brain Atrophy and NeuroQuant® Hemorrhage reports.

**Brain Atrophy Report**

- Statistically significant atrophy (>2 SD below the norm) in:
- Left temporal lobe
- Left hippocampus
- Left amygdala
- Left fusiform gyrus
- Statistically significant ventricular enlargement
- No appreciable volume change over a 2-month MRI interval, allowing clinicians to confirm stability in the post-acute phase

**Hemorrhage Report**

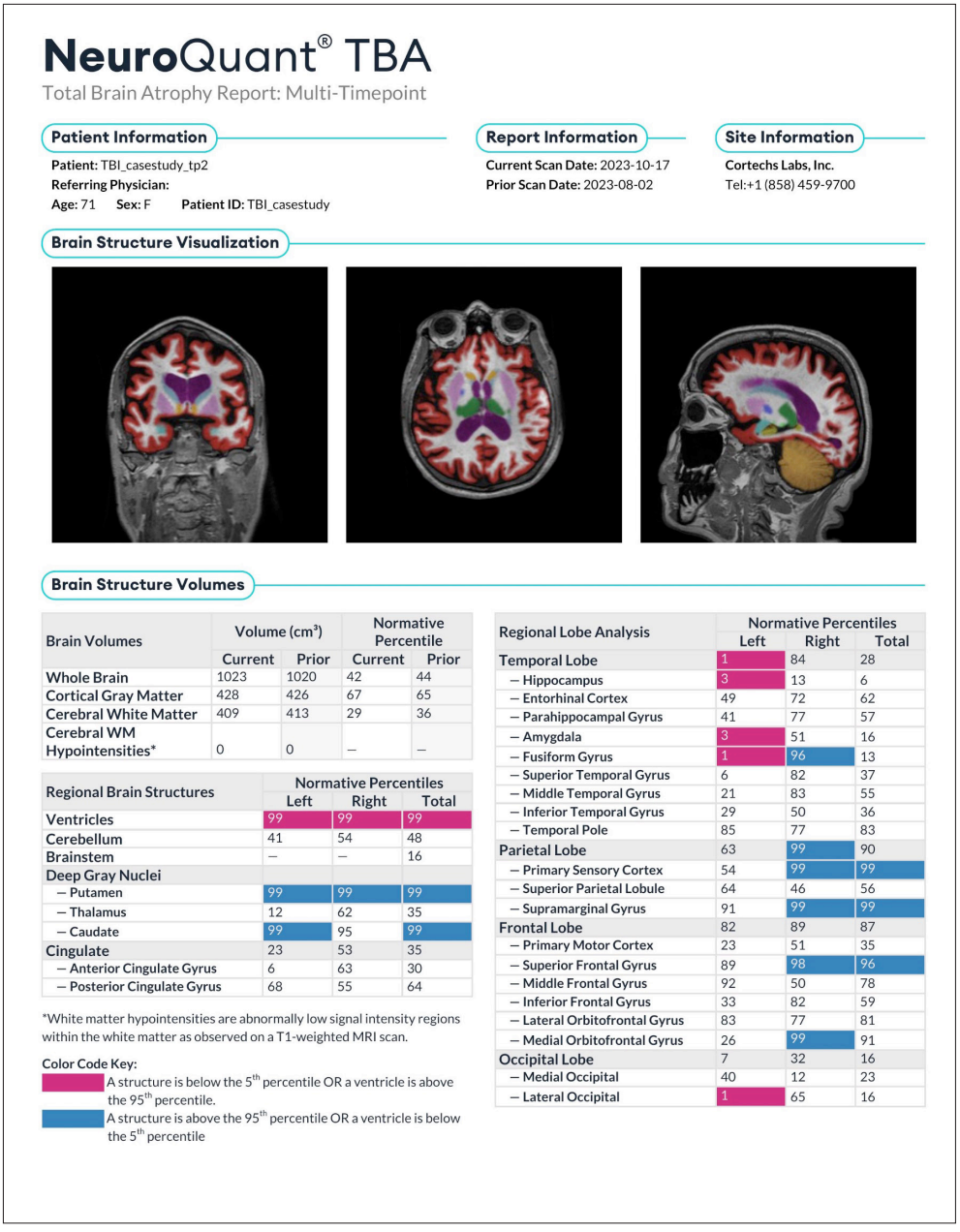
- Microhemorrhages: 2 (stable since the prior MRI)
- Macrohemorrhages: 2 (stable since the prior MRI)
- Superficial siderosis: 6 regions affected (no progression since the prior MRI)
- Automated segmentation provided visual and quantitative data on hemorrhage location and type (color-coded by category)

# 4. Clinical Utility and Value of NeuroQuant® TBI

- Improved diagnostic clarity by objectively quantifying brain volume loss and hemorrhage burden
- Reduced reader subjectivity with standardized comparison to a normative database
- Longitudinal tracking capabilities allowed for easy monitoring of neurodegeneration or progression
- Time-saving features through automated identification of hemorrhagic areas (micro, macro, siderosis)
- Billing supported by CPT Category III codes (0865T, 0866T), with observed Medicare reimbursement success in multiple regions

## The NeuroQuant® TBA Report

The NeuroQuant® Triage Brain Atrophy Report is for the assessment of traumatic brain injury and other neurodegenerative conditions. It showcases 47 brain structures for both the right and left hemisphere, sorted by lobe and region. It may be utilized in the clinical assessment of neurodegenerative conditions, such as brain trauma, post-traumatic stress disorder (PTSD), diffuse axonal injury (DAI), chronic traumatic encephalopathy (CTE), or other conditions that require comprehensive lobar evaluation.



**NeuroQuant® TBA**

Total Brain Atrophy Report: Multi-Timepoint

**Patient Information**

**Patient:** TBI_casestudy_tp2
**Referring Physician:**
**Age:** 71 **Sex:** F **Patient ID:** TBI_casestudy

**Report Information**

**Current Scan Date:** 2023-10-17
**Prior Scan Date:** 2023-08-02

**Site Information**

**Cortechs Labs, Inc.**
Tel:+1 (858) 459-9700

**Brain Structure Visualization**

**Brain Structure Volumes**

| Brain Volumes | Volume (cm³) | | Normative Percentile | |
|---|---|---|---|---|
| | Current | Prior | Current | Prior |
| Whole Brain | 1023 | 1020 | 42 | 44 |
| Cortical Gray Matter | 428 | 426 | 67 | 65 |
| Cerebral White Matter | 409 | 413 | 29 | 36 |
| Cerebral WM Hypointensities* | 0 | 0 | – | – |

| Regional Brain Structures | Normative Percentiles | | |
|---|---|---|---|
| | Left | Right | Total |
| Ventricles | 99 | 99 | 99 |
| Cerebellum | 41 | 54 | 48 |
| Brainstem | – | – | 16 |
| Deep Gray Nuclei | | | |
| – Putamen | 99 | 99 | 99 |
| – Thalamus | 12 | 62 | 35 |
| – Caudate | 99 | 95 | 99 |
| Cingulate | 23 | 53 | 35 |
| – Anterior Cingulate Gyrus | 6 | 63 | 30 |
| – Posterior Cingulate Gyrus | 68 | 55 | 64 |

*White matter hypointensities are abnormally low signal intensity regions within the white matter as observed on a T1-weighted MRI scan.

Color Code Key:
A structure is below the 5th percentile OR a ventricle is above the 95th percentile.
A structure is above the 95th percentile OR a ventricle is below the 5th percentile

| Regional Lobe Analysis | Normative Percentiles | | |
|---|---|---|---|
| | Left | Right | Total |
| Temporal Lobe | 1 | 84 | 28 |
| – Hippocampus | 3 | 13 | 6 |
| – Entorhinal Cortex | 49 | 72 | 62 |
| – Parahippocampal Gyrus | 41 | 77 | 57 |
| – Amygdala | 3 | 51 | 16 |
| – Fusiform Gyrus | 1 | 96 | 13 |
| – Superior Temporal Gyrus | 6 | 82 | 37 |
| – Middle Temporal Gyrus | 21 | 83 | 55 |
| – Inferior Temporal Gyrus | 29 | 50 | 36 |
| – Temporal Pole | 85 | 77 | 83 |
| Parietal Lobe | 63 | 99 | 90 |
| – Primary Sensory Cortex | 54 | 99 | 99 |
| – Superior Parietal Lobule | 64 | 46 | 56 |
| – Supramarginal Gyrus | 91 | 99 | 99 |
| Frontal Lobe | 82 | 89 | 87 |
| – Primary Motor Cortex | 23 | 51 | 35 |
| – Superior Frontal Gyrus | 89 | 98 | 96 |
| – Middle Frontal Gyrus | 92 | 50 | 78 |
| – Inferior Frontal Gyrus | 33 | 82 | 59 |
| – Lateral Orbitofrontal Gyrus | 83 | 77 | 81 |
| – Medial Orbitofrontal Gyrus | 26 | 99 | 91 |
| Occipital Lobe | 7 | 32 | 16 |
| – Medial Occipital | 40 | 12 | 23 |
| – Lateral Occipital | 1 | 65 | 16 |

**Figure 4.** The patient's automated NeuroQuant® Triage Brain Atrophy Report

## The NeuroQuant® Hemorrhage* Report

The NeuroQuant® Hemorrhage Report will support the evaluation of cerebral hemorrhagic findings by automatically detecting and segmenting microhemorrhages, macrohemorrhages, and superficial siderosis across brain regions. The report provides a regional summary with lateralized counts (left/right) for the frontal, temporal, occipital, and parietal lobes, as well as other brain regions, enabling consistent and reproducible hemorrhage tracking. It is particularly valuable in longitudinal follow-up, offering side-by-side comparisons between current and prior imaging to assist in assessing progression, treatment response, or the development of new hemorrhagic events.

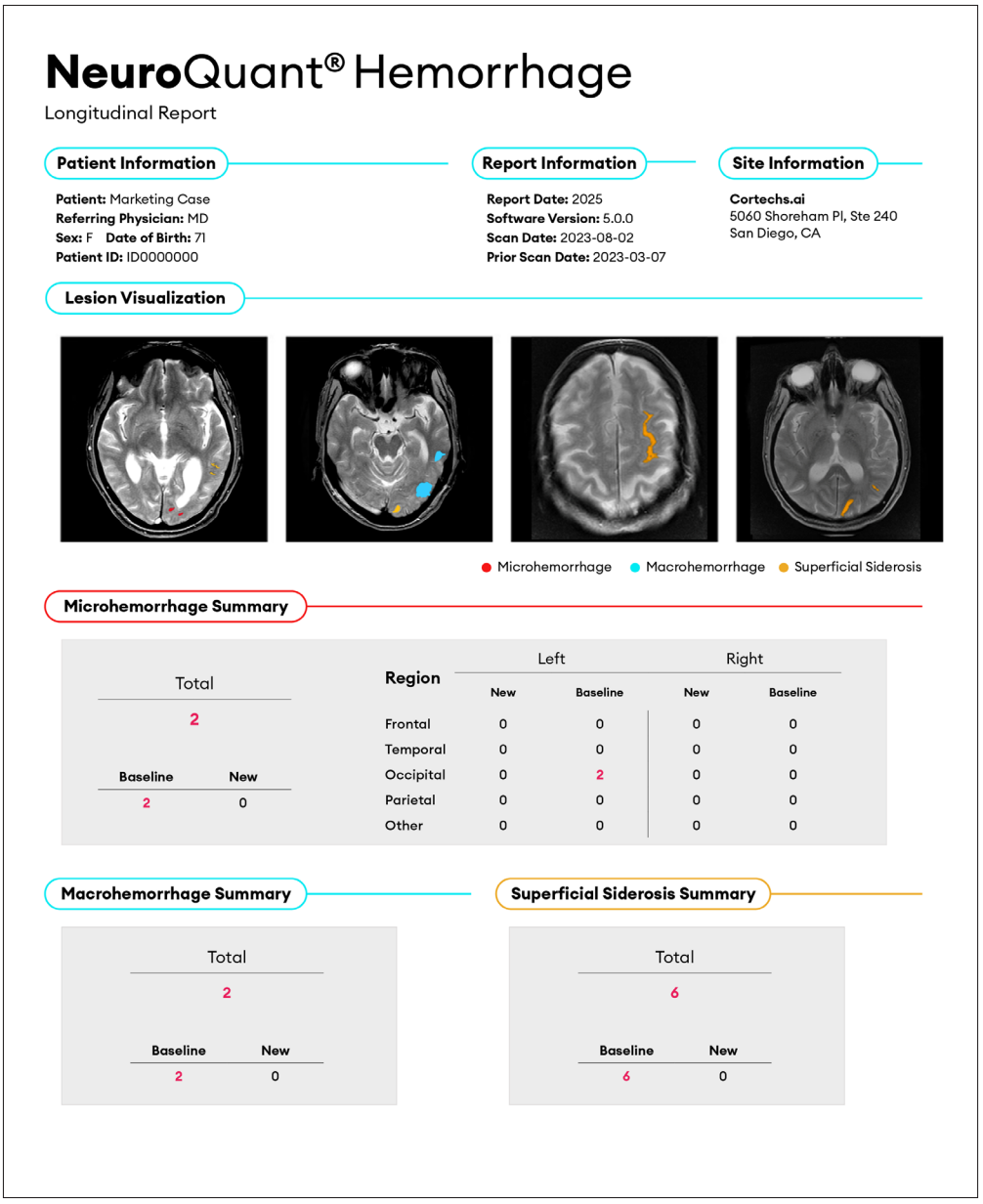



**Figure 5.** The patient's NeuroQuant® Hemorrhage* Report

**Custom report in development*

# 5. Conclusion

**This case highlights the practical and clinical value of incorporating NeuroQuant® TBI into the workup of TBI patients. For this patient, it enabled:**

- Insight into chronic structural changes that may not have been subjectively evident on follow-up MRI by visual inspection alone
- Reduced reader subjectivity with regard to the count and location of post-traumatic findings
- Efficiency gains with respect to counting and reporting intracranial blood products
- Objective evidence of left-sided temporal lobe atrophic neurodegeneration
- Data-supported communication between radiologist and referring providers for treatment planning

**NeuroQuant® continues to prove itself a reliable, reimbursable, and efficient tool in the evaluation and follow-up of traumatic brain injury.**

# 6. About RadNet

RadNet is the largest provider of freestanding outpatient diagnostic imaging services in the United States. They operate over 400 centers in eight states, with over 10 million exams performed annually, including hundreds of thousands of brain scans. There are over 100 fellowship-trained Neuroradiologists at RadNet. RadNet offers AI-driven solutions under its DeepHealth brand.

# 7. About Dr. Suzie Bash

## Suzie Bash, MD

### Neuroradiologist and a Medical Director at RadNet

Dr. Bash is a Neuroradiologist and a Medical Director at RadNet. Prior to this she was on faculty at UCLA as an Assistant Professor of Neuroradiology, after completing a 2-year neuroradiology fellowship and residency also at UCLA.

Dr. Bash's passion and interests lie in artificial intelligence (AI) applications in advanced neuroimaging which add patient-centric value and quality. Dr. Bash has a special interest in dementia imaging and Alzheimer's disease educational initiatives. Dr. Bash is a recurring guest on TV, radio, and podcasts and is actively involved in AI clinical trials, peer-reviewed publications, as well as AI and dementia related educational talks and webinars.

Dr. Bash is the Chief Medical Officer of Cortechs.ai. She also serves on the Editorial Board in the AI section for Applied Radiology and is a frequent contributing author to this journal.